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Value chain governance in the eucalyptus value chain in Mecha district, Amhara region, Ethiopia

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Tiivistelmä – Referat – Abstract

Eucalyptus growing by smallholders for financial income has rapidly expanded in the district of Mecha, Amhara region, Ethiopia. Nevertheless, a lack of market knowledge on final consumer markets is limiting the income that smallholders receive for their eucalyptus poles. This study aims to uncover the barriers to market knowledge transfer hindering smallholders from receiving higher incomes for their products by analyzing the vertical coordination of actors in the value chain.

The qualitative study was based on the Global Value Chain framework, which uses the theory of chain governance to explain the vertical coordination amongst actors. For the study, 18 semi-structured interviews (5 smallholders, 6 traders, 3 service providers, 2 experts, 2 regulators) were conducted with individuals and groups representing a total of 21 individuals. The interviews were transcribed and edited for theory-driven thematic analysis.

The coordination between smallholders and traders falls closest to the market governance type meaning that transactions are based on price and product specification. The increased demand for high-quality eucalyptus poles in Bahir Dar reflected by high prices is not communicated through the chain to the producers. This lack of knowledge on the price variation for different pole qualities, together with unclear local pole classification system, leads to the possibility for traders to exploit smallholder tree growers to gain higher rent.

Linking woodlot valuation to the market demand in Bahir Dar, increasing smallholders' knowledge on the price variation for different qualities of poles, and improving the local pole classification system to include pole quality could enable tree growers in Mecha district to achieve higher financial benefits from their participation in the eucalyptus pole value chain.

Avainsanat – Nyckelord – Keywords

Eucalyptus pole value chain, Ethiopia, Amhara, Market knowledge

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Glossary

BOA – Bureau of Agriculture

EFWCDA - Environment, Forest and Wildlife Conservation and Development Authority

ETB – Ethiopian Birr

GVC – Global value chain

ha - hectare

M - million

PC – Primary Cooperative

RBV – Resources based view

1 Introduction

1.1 Background of the study

Eucalyptus was introduced to Ethiopia around the year 1904 under Emperor Menelik II to solve the drastic fuelwood shortage of the capital Addis Ababa caused by the continuous cutting of surrounding natural forest for construction, heating, and cooking purposes (Pankhurst 1961). The introduction of eucalyptus was a success due to its rapid growth and coppicing ability, which consequently lead to the establishment of large-scale plantations around the capital (Pankhurst 1995).

During the socialist era from the year 1975 to about 1994, forestry received a lot of political support but the power arrangement was highly centralized with a strong top-down approach (Ayana et al. 2013). The socialist government pushed for collective ownership of the land and starting from the year 1980, the agricultural land and forests were nationalized and private tree ownership was limited to the homesteads and church compounds (Kassa et al. 2011). Moreover, forced resettlements due to the government villagization program and the requirement to apply for permits for the harvest of one's own trees were major disincentives to smallholders to engage in tree planting and caused weak tenure security (ibid).

In the year 1991, the socialist regime was overthrown by a coalition of rebel forces, and a new constitution was approved in 1995 which gave peasants land rights (Kassa et al. 2011). Furthermore, the Forest Proclamation of 1994 improved the tenure security by introducing forest ownership as a property regime, and the government price control on timber was lifted (ibid). With the opening of the markets and the ongoing focus on increasing land tenure, smallholders have slowly started to engage in the planting of eucalyptus woodlots. Based on the review of several studies conducted between the years 1996 to 2009, Lemenih (2010) estimates that the expansion of eucalyptus planting started around the year 2000.

Ethiopian smallholders appreciate eucalyptus due to its ecological characteristics and growth performance. Thanks to its wide adaptability to different site and climatic conditions the Eucalyptus genus can be widely planted throughout Ethiopia (Pohjonen and Pukkala 1991). Furthermore, its fast growth rate compared to other tree species, ease of establishment, high coppice-ability and unpalatability to domestic animals keep management costs and risks low compared to agricultural products (Pohjonen and Pukkala 1990; Mekonnen et al. 2007; Adimassu et al. 2010; Gebreegziabher et al. 2010; Mekonnen 2010; Jenbere et al. 2012; Yitaferu et al. 2013).

The two species of eucalyptus planted by smallholders are *Eucalyptus globulus* and *Eucalyptus camaldulensis* (Abiyu et al. 2016; Addis et al. 2016). In general, eucalyptus is planted on woodlots, farmland, and around homesteads (Hailu et al. 2010; Abiyu et al. 2016). Other forms are row plantings

along farm boundaries and scattered plantings in multi-story home garden agroforestry or coffee shade systems (Lemenih 2010).

Farmers establish woodlots with high planting densities between 10,000 N/ha and 25,000 N/ha (Kelemu and Tadesse 2010). With high planting densities, smallholders account for mortality and try to achieve an early harvest of fuelwood (Kidanu 2004). Smallholders manage their eucalyptus stands in coppicing systems (Ayele 2008). Depending on the final product and site conditions, rotation length varies between 5 to 10 years (Lemenih 2010).

Eucalyptus planting has become a viable option for smallholders to diversify and increase their household income resulting in improved livelihoods (Addis et al. 2016). Eucalyptus planting is regarded by farmers as a "bank" or "safety net" because it is easily and quickly converted to cash whenever needed which can lower-income risks of agriculture production due to drought and pests (Lemenih 2010; Matthies and Karimov 2014; Feyisa et al. 2018). The motivation to grow eucalyptus was initially for subsistence but income generation has become the key driver for eucalyptus woodlot establishment by smallholders (Lemenih 2010).

The high domestic market demand for wood products, fuelwood, and charcoal is increasing the supply and demand gap. For 2013 the consumption of wood was estimated to be 124 M m^3 roundwood out of which 110 M m^3 were for fuelwood and 7 M m^3 for the construction sector (MEFCC 2017). Private smallholder eucalyptus woodlots supplied 6.6 M m^3 roundwood as fuelwood and 5 M m^3 poles for the construction sector, which highlights the importance of smallholder woodlots in the supply of timber (ibid). The supply and demand gap is estimated to increase to 4.4 M m^3 by 2033 as demand is forecasted to increase (ibid).

The need for sustainable forestry management becomes evident when looking at deforestation rates in Ethiopia. Based on FAO (2020) data the forest area in Ethiopia has reduced from 19.3 M ha in 1990 to 17.0 M ha in 2020. To combat deforestation in 2014 the Ethiopian government committed to reforest 7 million ha of land and restore 15 million ha of degraded land as part of the UN New York declaration on forests and the Bonn Challenge. Smallholders are recognized by the government as an important driver for reforestation and sustainable forest management (MEFCC 2017).

As demand for eucalyptus will continue to remain strong in the future and the government is supporting reforestation and sustainable forestry, it becomes important to ensure that smallholder tree growers will receive financial benefits from their engagement in the eucalyptus value chain.

Munuyee (2018) found that traders' value-addition and commercialization margins are exceptionally high compared to tree growers' ones in the eucalyptus pole value chain in Southern Ethiopia. He reasons that those traders can market large quantities of eucalyptus poles within a short time in contrast to tree growers who have a minimum production period of 5 years until eucalyptus poles can be harvested

(ibid). Both Munuyee (2018) and Tsedalu (2017) conclude that the lack of market knowledge hinders smallholders to increase their benefits in the value chain.

1.2 Aim of the study

The study aims to contribute to the improvement of livelihoods of rural smallholder tree growers in Mecha district by identifying the issues of market knowledge transfer in the eucalyptus pole value chain that hinder smallholders from receiving higher income. Based on the description of the value chain, the global value chain (GVC) governance form is determined, and intervention options are provided to overcome the barriers to effective market knowledge transfer.

The two specific objectives set out for the study are:

Objective 1:	To describe the eucalyptus pole value chain from production by smallholder tree growers in Mecha district to the final market in Bahir Dar city and to determine the most significant market channel for GVC governance analysis.
Research question 1.1:	What are the commercial eucalyptus products and how are they classified and quantified?
Research question 1.2:	How is the spatial flow from the production area to end markets?
Research question 1.3:	What are the functional stages of the value chain?
Research question 1.4:	Who are the actors involved in the eucalyptus pole value chain, and what activities do they carry out?
Research question 1.5:	What possible marketing channels exist for eucalyptus poles? Which is the most significant channel?
Objective 2:	To analyze the GVC governance form for each transaction in the selected marketing channel and to provide targets for interventions to improve the transfer of market knowledge.
Research question 2.1:	What GVC governance form describes the transactions in the select marketing channel best?
Research question 2.2:	What issues pose a barrier to the transfer of market knowledge?

2 Conceptual framework and literature review

The study takes a global value chain point of view to explore the transfer of market knowledge in the eucalyptus pole value chain in the Amhara region of Ethiopia. According to Frederick (2019) GVC research is done in two steps: 1) description of the value chain, and 2) analysis. Correspondingly, the first objective is to describe the eucalyptus pole value chain and the second one is to analyze how actors coordinate their transactions, which is theorized as governance in the GVC literature.

The conceptual framework is developed in three steps. First, the theoretical underpinnings of the GVC framework and its theory of governance are outlined. Secondly, the context of the eucalyptus pole value chain in Ethiopia is explored through a literature review. Thirdly, the study context and theoretical underpinnings are combined to develop a conceptual framework for the study.

2.1 Theoretical underpinnings of the GVC framework and governance

The GVC framework consists of four dimensions which are the (1) input-output structure, (2) governance, (3) geography, and (4) institutional setting (Gereffi 1994; Fernandez-Stark and Gereffi 2011) (see Figure 1).

The input-output structure is the "set of products and services linked together in a sequence of value-adding economic activities " (Gereffi 1994). It describes the transformation from raw materials to a final product (Fernandez-Stark and Gereffi 2011). Kaplinsky and Morris (2002, p. 4) put the input-output structure at the core of the framework and define it as the "full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use" (see Figure 1).

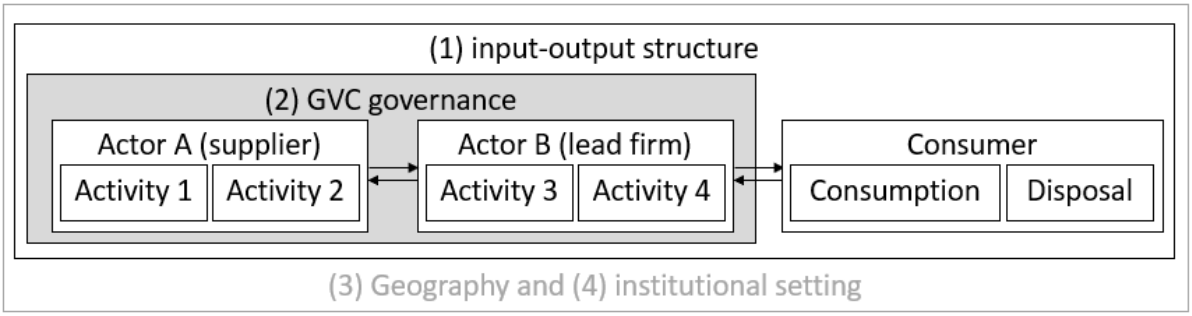


Figure 1: Visualization of the global value chain framework based on (Gereffi 1994)

The input-output structure includes the actors, who perform activities to bring a product to the market, as well as their interactions. These interactions can be seen from a vertical and horizontal perspective (Trienekens 2012). The vertical perspective is the flow of products and information between actors at different stages of the chain, whereas the horizontal interactions are between actors performing similar activities at the same stage. Horizontal interactions can be as simple as sharing information about

activities or market information and up to more formal organizations such as associations, cooperatives, or joint investments (Trienekens 2011).

In the value chain development literature Springer-Heinze (2018a) puts forward four types of actors. Within the input-output structure the "value chain operator" is the actor who takes possession of the product. Additionally, specialized operational "service providers" are hired or subcontracted by the operator to complete certain tasks e.g., transport.

Whereas the input-output dimension of the value chain is primarily descriptive (Kaplinsky 2013), the dimension of GVC governance is analytical as it aims to explain the coordination in transactions between value chain operators (Gereffi et al. 2005; Sturgeon 2008). The analysis is based on three factors:

(1) capabilities of actual and potential suppliers concerning the requirements of the transaction,
(2) the complexity of the information and knowledge transfer required to sustain a particular interfirm transaction, specifically for product and process specifications,
(3) and the degree of codification of that information and knowledge for efficient transmission between firms without transaction-specific investment (Gereffi et al. 2005).

If these factors score high or low (two values), one of 5 idealized governance types is identified (Gereffi et al. 2005) (see Figure 2).

Governance type	Complexity of transactions	Ability to codify transactions	Capabilities in the supply-base
Market	Low	High	High
Modular	① ↓ High ② ↑	③ ↑ High ④ ↓	⑤ ↑ High ⑥ ↓
Relational	↓ High	↑ Low	↑ High
Captive	High	High	Low
Hierarchy	High	Low	Low

Figure 2: Scoring of factors for GVC governance types (Gereffi et al. 2005)

The concept of "complexity" is defined as "complexity of the information and knowledge transfer required to sustain a particular interfirm transaction, particularly with respect to product and process specifications" (Gereffi et al. 2005, p. 85). The complexity of a transaction is based on buyers' requirements. The buyer wants to buy a certain product, which the supplier must produce and supply, based on the buyers' requirements.

The concept "codification" is defined as "the extent to which […] information and knowledge can be codified and, therefore, transmitted efficiently and without transaction-specific investment between the parties to the transaction" and "the degree to which this complexity can be mitigated through codification" (Gereffi et al. 2005, p. 85). Codification can be in form of manuals, standards, and general

parameters which are used to exchange information between the lead firm and the supplier for the transaction.

The "capabilities" in the supply base are defined by Gereffi et al. (2005, p. 85) as "the capabilities of actual and potential suppliers in relation to the requirements of the transaction" and "the extent to which suppliers have the necessary capabilities to meet the buyers' requirements." The concept of capabilities originates from the resources-based view (RBV) theory. Amit and Schoemaker (1993) define capabilities as the firms' ability to use its resources through organizational processes to perform tasks to reach a desired end. In the context of GVC governance smallholders are viewed as a firm as done by Gereffi et al. (2005) in their example case study of the fresh vegetable value chain between Kenya and the United Kingdom.

Resources are all the assets, capabilities, organizational processes, firm attributes, information, and knowledge within the firm (Daft in Barney 1991). According to Barney (1991) they can be grouped into physical capital (physical technology, plants, equipment, geographic location, and access to raw materials), human capital resources (training, experiences, judgment, intelligence, relationships, and individual insights of employees) and organizational capital resources (firm's formal reporting structure, formal and informal planning, controlling, coordinating systems and informal relations among groups within the firm and between a firm and its environment).

The three concepts of complexity, codification, and capabilities are connected. Gereffi et al. (2005) explain that lead firms increase complexity by placing new demands on a transaction. In contrast, complexity can be reduced by the lead firm and other private or public institution through the development of unambiguous and widely accepted technical and process standards (Gereffi et al. 2005). Consequently, the complexity of the transactions is based on buyers' requirements and product standards. Suppliers must be capable to meet the complexity of the transaction and codify the transaction.

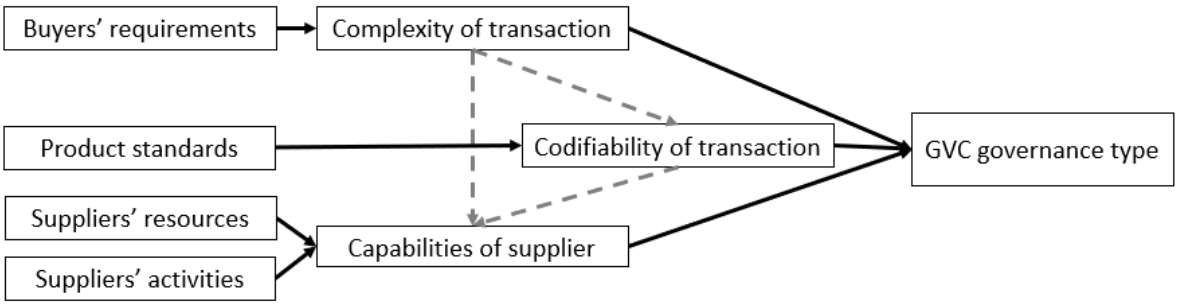


Figure 3: Theoretical framework for GVC governance analysis

2.2 Literature review on eucalyptus pole value chains in Ethiopia

Numerous studies have been conducted on eucalyptus growing by smallholders in Ethiopia but studies focusing on the eucalyptus pole value chain are rare. Two previous MSc studies (Tsedalu 2017; Munuyee 2018) and one GIZ project report (Barbiche and Alemu 2016) were found. To better establish the context of smallholder tree growers' value chains further studies from Uganda (Abdul 2020) and Southern-Benin (Aoudji et al. 2012) were included in the review.

In Amhara region, eucalyptus value chains originate from two ownership/plantation forms. Out of the estimated plantation area of 684,000 ha, about 639,400 ha are non-industrial woodlots by smallholder tree growers and 44,600 ha are industrial forest plantations managed by the government-owned forest enterprise (Lemenih and Kassa 2014).

Two separate value chains emerge from the industrial and non-industrial plantations. Eucalyptus timber from industrial plantations makes its way to processing plants (e.g. chip wood boards), whereas non-industrial plantations are the main source for construction poles and energy (fuelwood and charcoal) (Lemenih and Kassa 2014). Construction poles, fuelwood, and charcoal are the main commercial products from smallholder eucalyptus woodlots in Amhara (Barbiche and Alemu 2016; Tsedalu 2017; Dessie et al. 2019) as well as in the Sidama region (Munuyee 2018). In Uganda, eucalyptus timber from smallholder tree growers is also used for sawmilling (Abdul 2020).

In Ethiopia, construction poles are used for the construction of traditional and modern houses as well as for scaffolding (Lemenih and Kassa 2014; Barbiche and Alemu 2016; MEFCC 2017). A widely used informal classification system for construction poles exists throughout Ethiopia with local variations in terminology, but are all similarly based on diameter, straightness, and length (Barbiche and Alemu 2016; Tsedalu 2017; Munuyee 2018).

The demand for eucalyptus poles is due to national and export markets. National markets are in the growing cities of the country where demand is driven by population and economic growth (Lemenih and Kassa 2014). In addition, the demand in Amhara is driven by the export market to Sudan (Barbiche and Alemu 2016).

The eucalyptus value chain from production to market has been broken down into the functional stages “input-supply”, “production”, “processing”; “trading” and “consumption” (Tsedalu 2017; Munuyee 2018). In Uganda, 7 stages were identified, most notably the stage of “secondary processing” for eucalyptus sawmilling, indicating a higher specialization in the chain (Abdul 2020).

The first stage “input supply” includes the provision of seedlings and farm equipment (Tsedalu 2017; Munuyee 2018). Seedlings are provided by NGOs, government organizations, development projects, as

well as sold by private nurseries or produced by the tree growers themselves (Tsedalu 2017; Munuyee 2018).

The second stage is identified as “production” and includes the activities regarding the site preparation, planting, and woodlot maintenance which are done by the smallholders with the option to hire additional labor to complete the tasks (Tsedalu 2017; Munuyee 2018). Smallholders planted 10,000 up to 20,000 seedlings per ha and manage the woodlot as a coppice system with an average 5-year rotation period (Tsedalu 2017; Munuyee 2018).

A third stage “processing” is put forward by Munuyee (2018) for the activities of harvesting, debranching, storing, loading, and unloading of poles, which are done by hired laborers and transport service providers. Tsedalu (2017) came to a similar result but points out that farmers engage in the “processing” stage if they do selective harvesting, which appears to be a smaller case.

The fourth stage “trading” is the domain of traders buying timber from smallholders and selling it to other traders. The activities performed at this stage are transporting, sorting, and selling to other traders or final customers (Tsedalu 2017).

In the case of Wogera district, Tsedalu (2017) identified several different marketing channels which ultimately led to the same final market. The channels differ in the number of traders involved but no distinction in regards to products traded is made. In contrast, the value chain from Chefasine district splits into fuelwood and pole wood channels leading to two different markets in Tulla town and Hawassa city (Munuyee 2018).

The consumption of eucalyptus poles in Amhara can be separated into rural and urban consumption as well as individual households or larger consumers. At the local rural level, growers and individual households use poles for construction or fuel (Tsedalu 2017). Larger consumers at urban markets are restaurants, hotels, universities, prisons, and construction companies (Tsedalu 2017). Charcoal is used by coffee shops and restaurants, and fuelwood by bakeries (Barbiche and Alemu 2016). Similar results are reported by Munuyee (2018) adding that construction poles are used for fuelwood after serving as scaffolding for the construction of modern buildings.

Taking a closer look at the actors, Tsedalu (2017) identified the actor groups of input providers, producers (smallholder tree growers), village traders, wholesalers, retailers, and consumers. Munuyee (2018) found similar actors in Sidama region with the addition of brokers, transporters, and hired labor. These actor groups appear to be commonly identified in the pole value chains as Abdul (2020) and Aoudji (2012) find similar groups in Uganda and Southern Benin.

Regarding marketing options for smallholders Tsedalu (2017) reports that 55% of the surveyed households choose to sell their woodlot standing whereas 38% tend to sell single harvested poles at the local market. In addition, Barbiche and Alemu (2016) found that roadside sales are an option for

smallholders but the primary choice is standing sale. Munuyee (2018) reports for Sidama Region that all producers interviewed sold their timber by standing sale. In the pole value chain in Uganda and Southern Benin standing sale was the dominant sales type (Aoudji et al. 2012; Abdul 2020). The discovered marketing choices are comparable to sales types used in the northern European Scots pine markets by primary producers as outlined by Malinen et al. (2015).

Looking at the actor group of traders several sub-groups can be identified. Tsedalu (2017) reports that 50% of the production is bought by the village-level trader who will sell a small amount at the local market and the vast majority to retailers or wholesalers taking the product out of the district. Munuyee (2018) found a similar network of traders which appears more differentiated due to specialization to fuelwood or pole wood.

Brokers, transport providers, and laborers for harvest are common service providers (Barbiche and Alemu 2016; Tsedalu 2017; Munuyee 2018). In Ethiopia harvest is done by ax (Munuyee 2018) whereas in Uganda chainsaws are commonly used by harvest groups (Abdul 2020). In regards to transport both donkey, mule or horse carts, and trucks are used for transportation (Barbiche and Alemu 2016; Tsedalu 2017; Munuyee 2018).

The transactions between tree growers and traders are direct or facilitated by a broker (Munuyee 2018). The main part of the transactions is the negotiation of the price which depends on the distance to market and pole assortment (Munuyee 2018). The transaction can be done with and without a written agreement (Tsedalu 2017). So far, the interaction amongst traders is not described in detail.

Taking a horizontal view, the main cooperation occurs amongst farmers who exchange market information (Tsedalu 2017). Furthermore, they receive training from chain supporters such as government organizations or foreign aid projects (Barbiche and Alemu 2016; Tsedalu 2017). Barbiche and Alemu (2016) as well as Munuyee (2018) report that traders at the landing site exhibit some level of horizontal interaction for the application of trading licenses. In Southern Benin, traders formed an organization to protect themselves from government harassment (Aoudji et al. 2012).

Comparing value distribution from different eucalyptus chains is difficult as the underlying calculations vary, and the market prices are subject to temporal and spatial changes. Tsedalu (2017) concludes that all actors made a profit and smallholder producers created a large proportion of value-added. This result is questionable as the analysis of value-added was not based on a fixed timeframe. Tree growers need a minimum of 5 years to grow eucalyptus poles, but traders need only a fraction of the time. Accordingly, Munuyee (2018) found that traders' value-addition and commercialization margins are exceptionally high compared to tree growers' in the eucalyptus pole value chain in Southern Ethiopia.

Looking at the governance, Munuyee (2018) concludes that the eucalyptus value chain in Sidama Region is coordinated by market governance, as transaction complexity is low, codification of the

product is high and capabilities at the supply base are high as well. Value chain studies in Uganda (Abdul 2020) and Southern Benin (Aoudji et al. 2012) report similar results.

2.3 Descriptive framework for the eucalyptus pole value chain

The first objective of this study is to explore and describe the input-output structure to serve as a framework for the second objective to analyze the GVC governance. The study takes the value chain view as defined by Kaplinsky and Morris (2002). Thus, the description of the eucalyptus pole value chain focuses on the three themes: (1) eucalyptus pole products and markets; (2) the actors at the input-output structure, and (3) their transactions.

This study focuses on eucalyptus pole products and markets from smallholder woodlots. The value chain elements to be described are product standards, markets and product flow, and marketing channels. Based on the literature review, the demand for eucalyptus poles is due to national and export markets. National markets are in the growing cities of the country where demand is driven by population and economic growth (Lemenih and Kassa 2014). In addition, the demand in Amhara is driven by the export of eucalyptus poles to Sudan (Barbiche and Alemu 2016).

As previous studies have shown, actors use a local classification system to group poles (Barbiche and Alemu 2016; Tsedalu 2017; Munuyee 2018). According to GVC governance theory, the complexity of a transaction is partially due to the complexity of the product which is reduced by standardization allowing for precise quantification and classification of the product (Gereffi et al. 2005). Consequently, the coordination amongst actors will strongly depend on how well the used classification system works for quantification and classification.

At the input-output structure, products advance from one functional stage to another (Kaplinsky and Morris 2002). As defined in the literature review, the eucalyptus pole value chain in Ethiopia is expected to consist of 5 stages: input supply, production, processing; trading, and consumption (Tsedalu 2017; Munuyee 2018). Regarding the actors, the literature review showed that smallholder tree growers and traders are the two types of chain operators (Barbiche and Alemu 2016; Tsedalu 2017; Munuyee 2018).

Both functional stages and actors are visualized in Figure 4. The first two stages “input-supply” and “production” group the activities needed for woodlot establishment and management, which are done by smallholder tree growers. The following stages of “processing” and “trading” are handled by a network of traders, involving the activities of harvest, pole processing, trade, and transport.

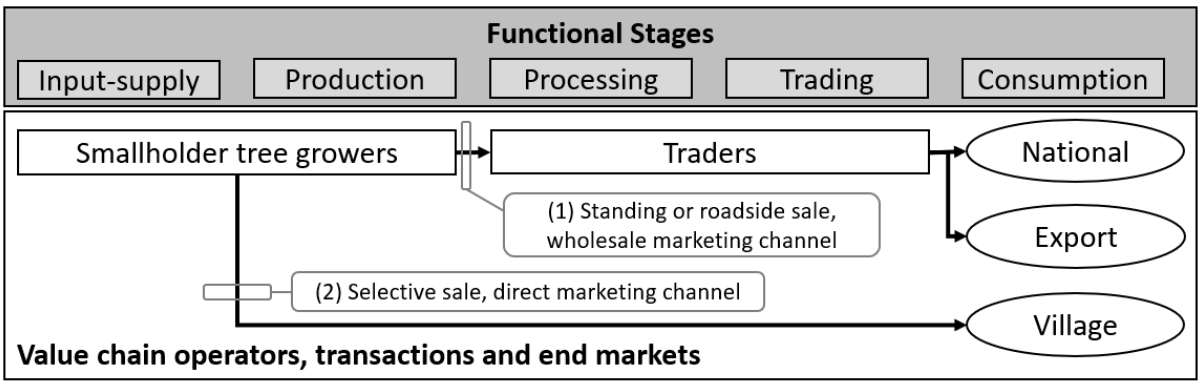


Figure 4: Conceptual framework of the description of the eucalyptus pole value chain

To participate in the value chain, tree growers have three options for marketing their poles. The primary marketing option is standing sale, further options are roadside sale and selective sale (Barbiche and Alemu 2016; Tsedalu 2017; Munuyee 2018). In standing or roadside sales, a large quantity of poles (minimum about 600 poles) is sold to traders. Whereas in selective sales, single poles are directly sold to consumers through the local village market (see Figure 4). Thus, tree growers enter both the wholesale as well as direct retail marketing channels.

2.4 Analytical framework to determine the GVC governance in the eucalyptus value chain

As outlined in the theory section, GVC governance is the coordination of a transaction between two value chain operators (Sturgeon 2008). The literature review showed that the wholesale channel is the expected channel preferred by the actors. Thus, all transactions occurring in the channel are subject to analysis. The results for each transaction will be linked to each other to see what knowledge and information are transferred.

The conceptual framework for analyzing the GVC governance in the eucalyptus pole value chain is visualized in Figure 5. On the left side, the observable factors are presented which are the elements of the previously established input-output structure. These observable factors are linked to the three factors of “complexity of the transaction”, “codifiability of the transaction” and “capabilities of the supplier” which determine the GVC governance form (Gereffi et al. 2005; Sturgeon 2008).

The analysis starts with the determination of the buyers’ requirements as this sets the complexity of the transaction of eucalyptus poles. For each transaction, the complexity needs to be assessed, which consists of two parts. On the one side, the question is how difficult it is to produce, and on the other side how difficult are the activities that must be completed to provide the product according to buyers’ requirements. For example, in the standing sale transaction, the traders require to buy the whole woodlot. To determine the complexity of standing sale, the complexity of the whole woodlot as the transacted product must be assessed, as well as the difficulty of the different activities for growing and marketing the woodlot.

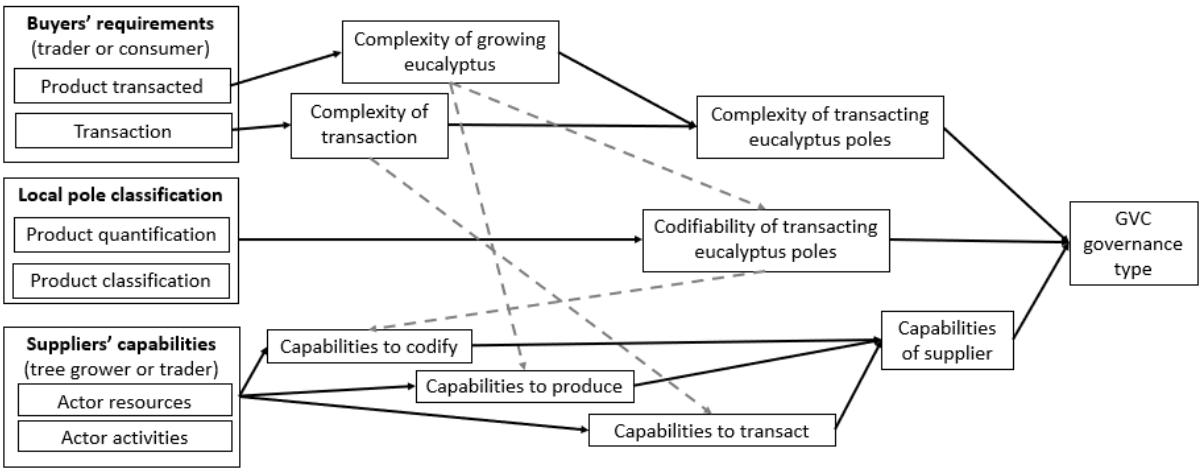


Figure 5: Conceptual framework for the study

As Gereffi et al. (2005) explain, the complexity of the transaction and product standards impact the codifiability of the transaction. From the literature review, it is known that a local eucalyptus pole classification system is widely used in Ethiopia. Hence, to assess the codifiability, it needs to be determined how well the complexity of the transacted product can be quantified and classified with the local pole classification system.

The remaining factor "capabilities of the supplier" determines if the supplier can meet the buyers' expectations and apply the used standard to codify the transaction. For a smallholder tree grower, this means to determine if he has the capabilities to grow and to engage in the transaction (capability to transact) as well as correctly apply the standard to codify the transaction (capability to codify).

The GVC governance results for each transaction will be compared. As the transactions are connected through the flow of product and knowledge, it should reveal where barriers exist. Once the barriers are identified, they can be targeted to improve the value chain.

3 Methods

3.1 Study site

The study focused on the eucalyptus pole value chain starting in Mecha district up to Bahir Dar city located in the West Gojjam Zone of the Amhara region (see Figure 6). Mecha district and its district capital Merawi were selected as the study site because of the high activity in the eucalyptus value chain regarding production and marketing, whereas Bahir Dar town is included as an important final market.

According to the national population census in 2007 the total population of Mecha district was about 292,080 inhabitants of which 93% were categorized as rural and 7% as urban (CSA 2007). Based on more recent projections the population has increased to about 350,757 (CSA 2013) in 2017. About 97% of houses in the district are built with timber and mud walls, and about 92% of the households use fuelwood and charcoal for cooking (CSA 2007) which generates a high local demand for eucalyptus poles, fuelwood, and charcoal.

Mecha district is at an altitude ranging from 1,800 to 2,500 masl and has a flat topography (Tafere et al. 2015). The reported mean temperature for Merawi is between 16-20°C and the mean annual rainfall is about 1,589 mm (Mamu 2020). A single rain season from June/July to September/October provides for only one rain-fed cropping per year (Mamu 2020).

Agriculture is the main source of income in Mecha district. Rain-fed, traditional subsistence smallholder farming on individual land holdings and animal grazing on communal lands are the dominant land-use forms (Mamu 2020). A shift from cereal production to tree plantation has been observed (Tefera and Kassa 2017; Kassie 2018). Tefera and Kassa (2017) found that the trend started in 2002 following the removals of agricultural subsidies as well as increased tenure security for smallholders through agricultural land certificates. The district is a nationally known eucalyptus production area due to the ongoing expansion fueled by national and international demand for timber products, especially from Sudan (Tefera and Kassa 2017).

Mecha district's capital Merawi is a key marketplace for eucalyptus products (Barbiche and Alemu 2016) and it is directly connected by the major road No. 3 to national timber markets such as Addis Ababa (618 km), Bahir Dar (35km), and Gondar (204km) (see Figure 6: Map of study site). Furthermore, the road continues to the town of Metema (383km) at the border to Sudan which is an important export outlet for eucalyptus poles (Melaku and Admassu 2011).

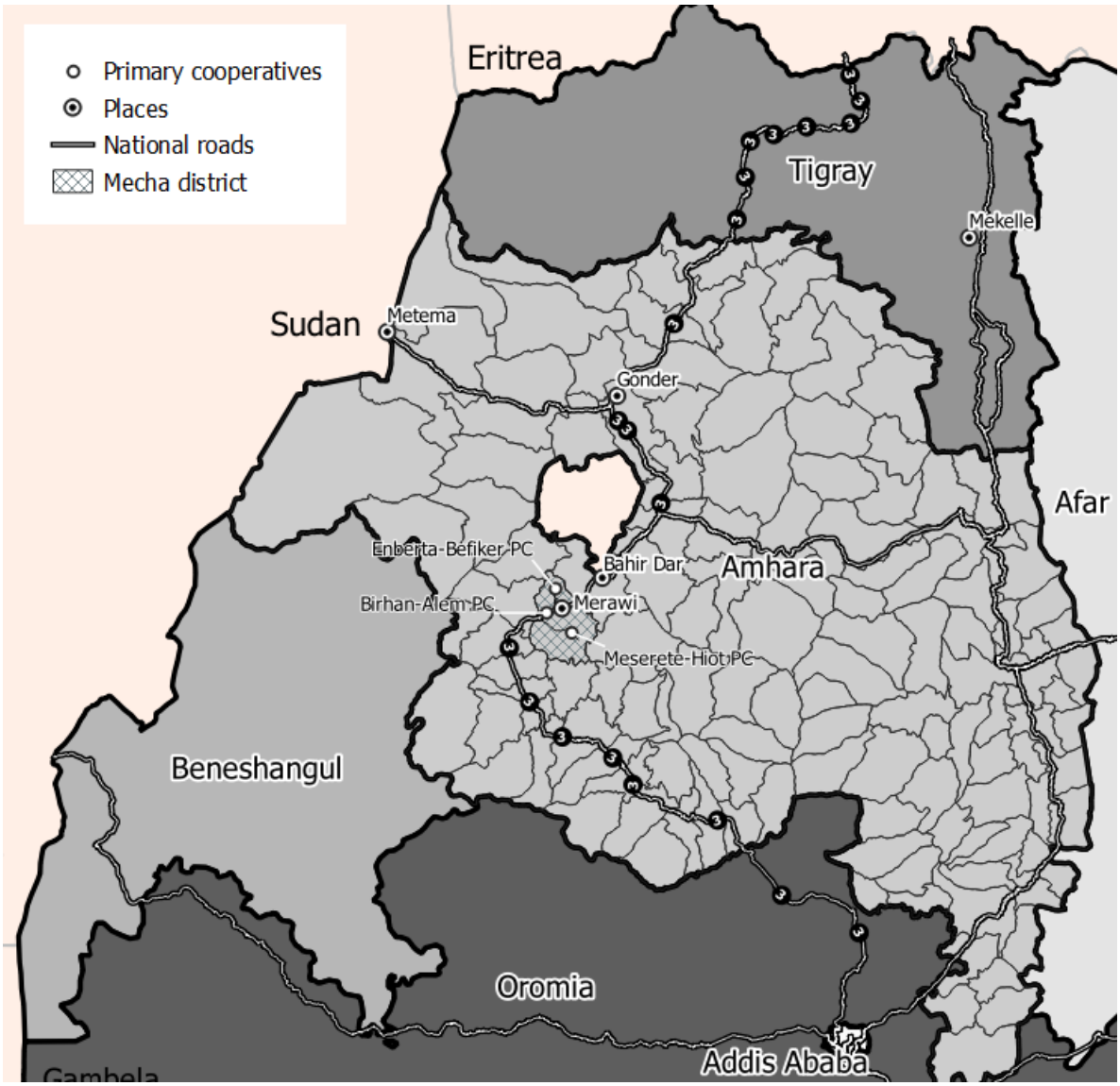


Figure 6: Map of the study site

Bahir Dar, the capital of the Amhara Region, is located only 35 km by road to the northeast of Merawi town. It is the closest final market for eucalyptus products (Barbiche and Alemu 2016). The population is estimated to be around 362,000 inhabitants based on projections for 2017 (CSA 2013). It is one of the growing cities in Ethiopia and it is the economic, political, and cultural center of the Amhara Region (Fitawok et al. 2020). In and around the city merchants are actively trading eucalyptus poles on several landing sites (Melaku and Admassu 2011).

3.2 Study design

Before the fieldwork, a literature review on eucalyptus value chains in Ethiopia was conducted to establish a background for the study. The fieldwork consisted of the following activities (1) interview and preparatory discussions with the value-chain experts, (2) interviews with the chain actors, (3) continuous revision of the questionnaire, and (4) mapping of the value chain. Each activity was

happening simultaneously throughout the fieldwork to account for the new information and to adapt the study design to maintain a clear focus. The interaction between these research activities and continuous adjustment of the research design is a typical process in qualitative studies (Maxwell 2009).

After the fieldwork, the collected primary data underwent thematic analysis. For the thematic analysis, a codebook based on the conceptional framework was created to direct the information from the semi-structured interviews towards their corresponding theme.

3.3 Sampling

Interview partners for the study were selected purposefully based on the individual's knowledge and experience with the study topic as well as their willingness to share the information (Patton 1990). Furthermore, their geographical location was a criterion for selection. The eucalyptus value chain selected for the study initiates in Mecha district, where smallholders are growing eucalyptus as woodlots. Members from three primary cooperatives (PC) were purposefully selected as interview partners as they were willing and open to participate in the study.

The PC Birhan Alem is located directly at the major road A3 close to the district capital Merawi, whereas Enberta Befiker is located about 16 km north and Meseret Hiot is about 37 km to the south of Merawi in the village of Rim (see Figure 6). The latter two cooperatives are only connected by an all-weather gravel road. Additionally, the cooperative marketing manager of Tiret Lediget PC, which does not fall into the study area, is included in the analysis as he provided relevant information on the marketing of eucalyptus poles by smallholder tree growers. Traders were located along the major road A3 as well as on several landing sites in Bahir Dar and were approached directly.

3.4 Data collection

The primary data was collected from March to April 2019 by semi-structured interviews which were designed based on the GVC value chain framework and targeted at specific actors. In addition, quantitative data was collected on eucalyptus pole prices and actors' costs. Furthermore, additional secondary data was encountered, which has been taken into consideration in the literature review and the discussion of the results.

Semi-structured interviews were found to be a suitable tool as limited prior knowledge of the research subject was available. In contrast, a structured interview would have been too restrictive and would not have allowed for new information to be discovered as previously stated by Leech (2002, p. 665) "[structured interviews would provide] reliable data that lacks any content validity", because the questions might not reveal anything about the research subject.

The questions were grouped by the following themes: (1) basic information about the interviewee, (2) product, (3) input, (4) activities performed, (5) output, (6) vertical interactions, (7) horizontal interactions, (8) intermediary and end markets, (9) constraints and upgrading, (10) chain supporters and

(11) chain regulators. The questionnaires evolved over the research period and more questions were added or rephrased to gain better insight.

The interviews were recorded for later transcription, given that the participants gave consent. Additionally, field notes were taken. For a list of interviews see Annex 3. The interviews were done with the help of a forestry expert translating between Amharic and English. Most of the interviews were done with individuals but some of the interviews were held with groups (i.e. interviews No. 4 and 18). In some cases, visits to the woodlot or the landing site were done to discuss details on site and cross-check the information provided by the interviewees.

3.5 Data analysis

The data analysis follows the two-step approach of GVC studies (Frederick 2019) starting with the qualitative description and visualization of the eucalyptus pole value chain which provides the basis for the GVC governance analysis.

3.5.1 Qualitative description and visualization of the eucalyptus pole value chain

Within GVC studies, the first step is value chain mapping which means identifying the value chain elements and establishing a framework for further analysis (Frederick 2019). The initial mapping process is done qualitatively to discover all the elements of the chain and their interactions (ibid). The result is a visual representation of the value chain as well as the framework for further analysis. The mapping started already during the fieldwork as the process itself informs the ongoing research. It is the first step in organizing the data as it defines what elements (for example actors, markets, products) exist in the value chain and how they relate to each other.

After the initial mapping and categorization, a more rigorous thematic analysis was used to systematically identify the value chain elements and their relation to each other. Braun and Clarke (2012) explain that thematic analysis can be approached inductively – what is in the data – or deductively – theory-driven. For this study, the data was analyzed deductively.

The chosen themes for the analyses consist of the value chain elements presented in the descriptive framework (see section 2.3). The codebook used for coding the interviews is presented in Table 1. The first theme focuses on the eucalyptus pole products with sub-themes for product standards, markets and product flows, functional stages, and marketing channels. The second theme captures the relevant information on the actors at the input-output structure focusing on their capabilities. The third theme is dedicated to the transaction taking place in the chain. An extended codebook for the description of the eucalyptus pole value chain is attached in Annex 2.

Table 1: Codebook for the description of the value chain based on the GVC framework

Value chain themes	Underlying elements	Definition
Product and markets of eucalyptus poles	- Product standard (quantification and classification) - Markets and product flow - Functional stages - Marketing channels	Information to describe the function of the eucalyptus pole value chain, such as product specification, product standards, markets, market prices, functional stages, and marketing channels. (Kaplinsky and Morris 2002; Gereffi et al. 2005)
Actor at the input-output structure	- Capabilities (activities and resources)	Information on the actor at the input-output structure regarding their activities, resources, capabilities, and further information relevant to the actor (Amit and Schoemaker 1993; Gereffi et al. 2005).
Transaction (vertical interaction)		Information on transactions (vertical interaction) (Gereffi et al. 2005; Trienekens 2012).

3.5.2 Analysis of GVC governance

To analyze the GVC governance of the transactions in the eucalyptus pole value chain, a second codebook was developed following the analytical framework for GVC governance presented in section 2.4. The three themes are based on the three factors determining the GVC governance, namely complexity of transacting eucalyptus poles, codifiability of transacting eucalyptus poles, and capabilities of supplier. As established in the analytical framework, the three factors are determined by the underlying value chain themes. Table 2 presents and defines the three governance themes. Furthermore, the table shows for each governance theme the underlying value chain theme which connects it to the descriptive codebook (see Table 1). An extended codebook for the GVC governance analysis is attached in annex 3.

The last step in the GVC analysis is to derive a scoring for the tree factor which is either low or high to arrive at one of the five analytical governance types put forward by Gereffi et al. (2005).

Table 2: Codebook for analyzing the GVC governance

Governance theme	Underlying value chain theme	Definition of the governance theme
Complexity of transacting eucalyptus poles	Product and markets of eucalyptus poles	The complexity of the information and knowledge transfer required to sustain a particular interfirm transaction, particularly with respect to product and process specifications (Gereffi et al. 2005).
Codifiability of transacting eucalyptus poles	Product and markets of eucalyptus poles	The extent to which information and knowledge can be codified and, therefore, transmitted efficiently and without transaction-specific investment between the parties to the transaction (Gereffi et al. 2005).
Capabilities of the supplier	Actor at the input-output structure; transaction (vertical interaction)	The capabilities of the actual and potential suppliers to meet the buyers' requirements in relation to the transaction. (Gereffi et al. 2005)

3.6 Limitations of empirical analysis

The selected study area in Amhara is one of the major eucalyptus production and trading clusters, thus it is well suited for a study on the value chain as several relevant actors were present in the area and it was likely that some of them were available to take part in the study.

The sampling approach was limiting the scope of the results to smallholder tree growers who were members of a primary cooperative (PC). Therefore, based on the assumption that information sharing works within PCs, it is important to note that it is likely that these eucalyptus growers linked to PCs had better access to information related to eucalyptus production and marketing than those growers that were not involved in the PCs. Furthermore, most of the interviewed PC members were part of the management boards of their PC. Assuming only more wealthy and powerful persons have time to take on such roles, the results on tree growers are likely to be skewed towards wealthier and better-connected individuals.

Moreover, it was not possible to conduct interviews with all the actors in the value chain which limits the reliability of the value chain description. No interviews could be conducted with daily laborers harvesting woodlots, truck transport service providers, and exporters. The insights from these actor groups are missing and information on their roles are derived from statements made by other actors.

The interview process posed a further threat to the reliability. The field interviews involved the three parties of researcher, translator, and interviewees. Questions and answers were translated between English and Amharic. As the interviews were free-flowing and new questions and prompts were frequent, it was at times challenging to ensure that all three parties understand the conveyed information.

Furthermore, in the case of long explanations by the interviewees, the answers were summarized during translation which takes away from the richness of the answer but at the same time allowed for a more fluent interview.

Lastly, not all interview situations could be controlled as they generally took place outside with several people observing, for example at the eucalyptus pole landing site, the interview with traders was with several people, which could cause participants to not share information that they perceive as sensitive to their business.

Regarding the analysis, the validity can be tested by comparing the results to other comparable value chain studies. Ultimately, the best option to check and guarantee for validity is the triangulation of the statement based on the multiple interview sources. If the information does not fit together it needs to be discussed as it points towards a validity issue (Schreier 2013).

4 Results

4.1 Description of the eucalyptus pole value chain from Mecha district

The results of the value chain mapping are based on the interviews conducted with chain actors and were visualized in Figure 7. First, a short overview of the value chain is provided followed by a detailed description in the following sub-sections on each of the elements of the value chain.

The value chain map presents the spatial flow of eucalyptus poles from Mecha district over Merawi town to Bahir Dar (see Figure 7). The poles went through the four functional stages of woodlot management, harvest, pole preparation, and trade and transport. The two chain operator groups were smallholder tree growers and traders. Tree growers mainly sold their poles by standing (referred as 1 in Figure 5) or roadside sale (2) to traders to enter the whole sale market channel. Furthermore, they could harvest poles selectively (3) and sell them directly to a local village market. Accordingly, tree growers were the only group active in the woodlot management stage. Depending on their marketing choice they were partially involved in the stages of harvest, pole preparation, and trade and transport. In general, traders were the main actors in charge of the stages of harvest, pole preparation, and the final trade and transport of the poles to the specific final markets.

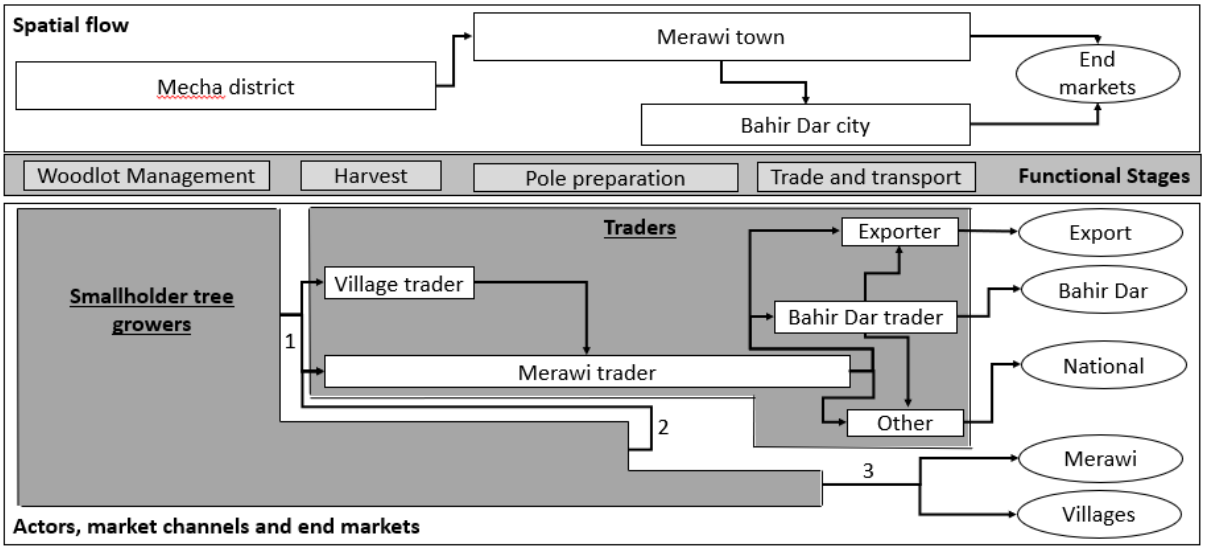


Figure 7: Map of the eucalyptus pole value chain from smallholder tree growers in Mecha district to the final market in Bahir Dar city

4.1.1 Functional stages

The eucalyptus pole value chain was split into 4 functional stages. The first stage was woodlot management, followed by harvest, pole preparation, and final trade (see Figure 8).

The activities in the first functional stage of woodlot management were seedling production, site preparation, and seedling planting, as well as weeding and young stand maintenance. Tree growers estimated that it takes about 5 years to grow marketable eucalyptus poles.

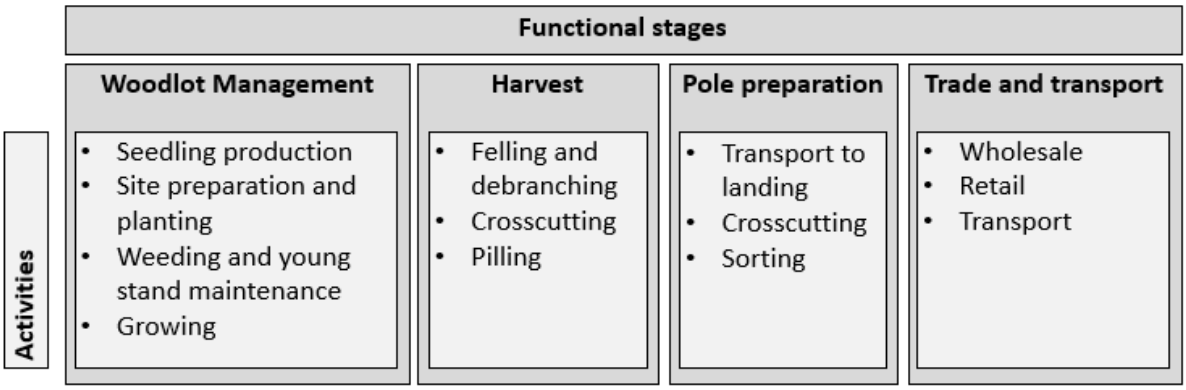


Figure 8: Functional stages of the eucalyptus pole value chain

The next stage of harvest included the activities of felling and debranching, initial crosscutting, and piling. After harvest, the poles went through the pole preparation stage. In this stage, the poles are transported to the landing sites in Merawi and prepared for further trade by sorting and crosscutting. Leftovers or crooked poles are either sorted as fuelwood or processed to charcoal.

The last functional stage, trade and transport, encompasses the trading of poles from Merawi to the final markets as well as the sale to final customers. The trade and transport activities include wholesale between traders, transport to final markets, and retailing to consumers.

4.1.2 Key products form smallholder eucalyptus woodlots

The key products discovered in the study are construction poles, fuelwood, and charcoal. These three products are commercially traded and have a strong market demand in Bahir Dar. Besides these three key products, further products are traded which are presented in Figure 9.

On a general level, eucalyptus products from smallholder tree grower's woodlot can be grouped into commercial and non-commercial (see Figure 9). Commercial products have markets with mass demand outside of the production area, whereas non-commercial products are limited to the tree grower's own use, for example as material for plows.

To describe the flow and transformation through the chain, commercial products can be further separated into intermediate and end products. Intermediate products are traded in the first stages of the chain. In contrast, end products reach the final consumer.

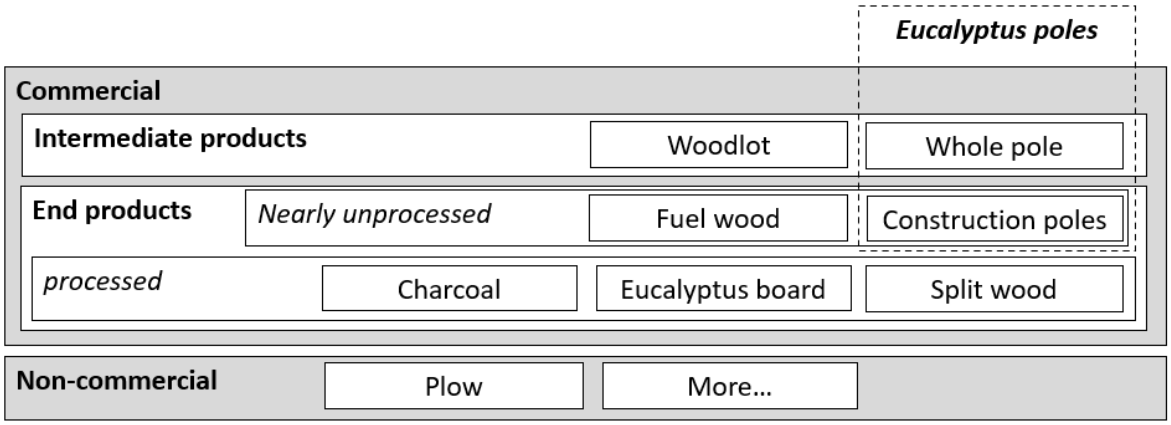


Figure 9: Eucalyptus products from smallholder tree grower's woodlot

Furthermore, end products are differentiated into processed and nearly unprocessed. Construction poles, which are only cut to length, or residues sold as fuelwood are nearly unprocessed. In contrast, charcoal, split wood, and eucalyptus board are processed. Split wood called "filt" in Amharic are manually split eucalyptus poles, usually from thicker trees, and used for wall constructions. Out of the three processed products charcoal is the most traded one, while split wood and especially sawn eucalyptus boards are niche markets.

Sawn eucalyptus boards were discovered while conducting interviews with the landing site group in Bahir Dar (ID-4). The landing group explained that eucalyptus poles exceeding the typical diameter classes are sold for sawmilling for 70 ETB/pole.

At the woodlot, the intermediate products depend on the sales type. In standing sale, the whole woodlot is traded, which includes all the parts of the eucalyptus tree above ground in a given area. This includes the whole poles, leaves, branches, and harvest residues. The area is usually one "kada", which is a local measurement and is about 0.25 ha. In roadside sales, the tree grower has harvested the woodlot and offers whole poles or construction poles for sale.

In this study, whole poles are the debranched and debarked eucalyptus poles in the full length of the tree (up to 15 m). In the processing stage of the value chain, the whole poles are crosscut to construction poles, which have a length of approximately 5.5 m to 7 m (Figure 10).

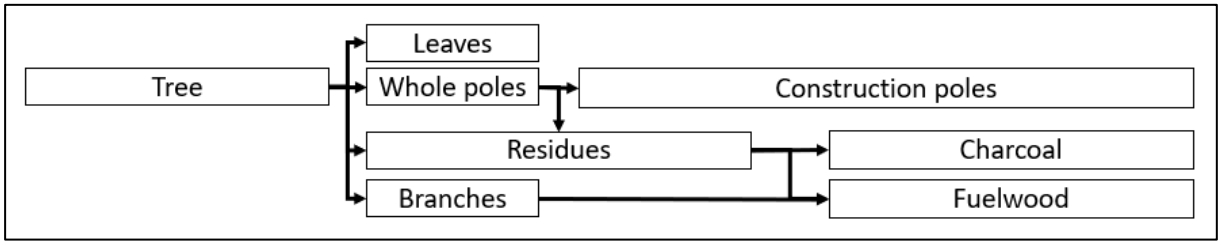


Figure 10: Eucalyptus tree to market products in the construction pole value chain

The construction poles are subdivided into 6 categories based on their diameter (see Table 3). Crooked or damaged poles are used for fuelwood or charcoal production. The Amharic naming originates from

the traditional house building and has regional variations even within a small area. A member of Meseret-Hiot PC (ID-12) explained that in the area around Rim “worage” poles are called “miss”.

This categorization of construction poles is not formalized and offers rough guidance for the actors. The categorization is done by visually estimating diameter and quality at any stage of the chain. No measurements are taken. It is functional but comes with its uncertainties.

The length of a construction pole varies considerably. For long transport distances, whole poles are cut to 5.5 or 6.5 m in length to maximize the amounts which are transported on trucks with trailers. In contrast, for short transport distances from Merawi to Bahir Dar poles are kept at 7 or 9 m in length and transported by a single truck. This standard is widely used but ambiguous.

Table 3: Construction pole categories

Category (Amharic)	**Diameter (cm)**	**Length (m)**	**Use**
Kench or Quami	>12	5.5 to 9	As pillars to hold walls and roofs
Worage or Miss	10	5.5 to 9	As beams to carry roof constructions
Mager	8	5.5 to 9	
Roof mager			for the construction of roofs
Wall mager			for the construction of walls
Kristi			for scaffolding and wall construction
Export poles	8 to 12	5.5 to 6.5	

The construction pole, fuelwood, and charcoal value chains are linked to each other but the charcoal value chain flows through different actors to final markets. Residues from harvesting or crosscutting the poles are either sold as fuelwood or further processed to charcoal (Figure 10). Charcoal is sold in bags called “kesha” which reportedly weigh about 25kg. The charcoal value chain was not the focus of this study, but it will be partially covered as it links to the construction pole value chain.

4.1.3 Price units and prices encountered in the value chain

This section presents how the different products are priced and give price examples. The units used are price per area in ETB/0.25 ha (kada) and price per pole in ETB/pole.

In a standing sale, tree growers sell the whole woodlot to a trader. The price of the woodlot can be expressed either as the total price per area (ETB/0.25ha) or by the average weighted price per pole and the number of poles. The area-based price can further be specified according to stand quality or type of stand (seedling stand or coppice stand). As the marketing expert of Tiret Lediget PC (ID-6) pointed out, a seedling stand is about 50,000 ETB/0.25ha and a coppice stand can be up to 80,000 ETB/0.25 ha. A cooperative member of Birhan Alem PC explained this in the following manner:

> *"[price…] depends on the age and quality. With good quality and a high number of kench, it can be sold for 40, 000 ETB. […]. With less kench and worage [poles], and lower quality, it can be even lower than 20,000 ETB. With increasing age, the number of kench and worage can increase and the number of small poles can be reduced."*

The average weighted price per pole is the result of the stand valuation done by the tree grower and the trader. For this, actors use the prices per pole class based on the currently ongoing rate in their locality, example prices are provided in Table 4. The process is based on determining the number of poles per pole class, then multiplying the number of poles and pole class price, summing the products, and ultimately dividing it by the total number of poles (see an example calculation in

Table 5).

Table 4: Price examples for pole class used for stand valuation by tree grower and trader

	Merawi		**Rim**
Pole class	**Tree grower (ID-8)**	**Trader (ID-17)**	**Tree grower (ID-12)**
Kench	20	50	40
Worage	18		33
Mager	17	25	15
Kristi	16	12	

Table 5: Example calculation of stand valuation

Pole class	Price per pole (ETB/pole)	Number of poles	Total (ETB)
Kench	40	50	200
Worage	33	500	16,500
Mager	14	950	13,300
Total		(A) 1500	(B) 30,000
Average weighted price per pole (B/A)			20

For roadside sales, the price is determined separately for the different pole classes as the actors know the exact number of poles, and sorting is done jointly. At Enberta Befiker PC (ID-18) the roadside prices were for worage 50 ETB/pole, mager 25 ETB/pole, and kristi 28 ETB/pole. At Meseret Hiot PC (ID-12) the prices were kench 43 ETB/pole, worage 36 ETB/pole, and mager 18 ETB/pole.

Different from tree grower and trader transactions, amongst traders only an average price per pole and the number of poles is used. Traders base their pricing on their experience and knowledge of buying prices and costs. In the interviews, traders provided buying and selling prices. For example, a trader in Merawi (ID-17) gave 30 ETB/pole as the average buying price and as selling price claiming that he makes his profit only with the sale of residues as fuelwood or charcoal. At Bahir Dar average buying price was between 42 to 50 ETB/pole (ID-2 and ID-4).

At the consumer markets, which can be at the village level, in Merawi or Bahir Dar the prices are provided per pole class. Retail prices in Merawi are based on diameter class. Example prices by a trader from Merawi (ID-17) are for kench 100 ETB/pole, and worage and mager 50 to 60 ETB/pole. The retail prices at Bahir Dar are based on quality: for low – 65 ETB, medium – 75 ETB, and high – 80 ETB (ID-2 and ID-4).

Table 6: Selling prices at different transactions in the eucalyptus value chain

Pole class	**Quality**	**Selling price per pole per pole class in ETB**		
		Tree grower (farmgate)	**Merawi trader (Merawi wholesale price)**	**Bahir Dar (Bahir Dar retail price)**
Kench	**High**	20 to 30	30	85
	Medium	20 to 30	30	75
	Low	20 to 30	30	65
Worage	**High**	18	30	85
	Medium	18	30	75
	Low	18	30	65
Mager	**High**	16 to 17	30	85
	Medium	16 to 17	30	75
	Low	16 to 17	30	65

4.1.4 Actor groups involved in the eucalyptus pole value chains

Actors in the value chain are grouped based on their roles. A detailed description of the actor groups at the input-output structure is given in section 4.2.

The actor groups are summarized in Figure 11 according to their role (operator, service provider, supporter, and enabler) as well as their dimension (input-output structure or institutional setting). Tree growers and traders are the two key groups operating in the eucalyptus pole value chain. Tree growers are heterogeneous due to their location, household characteristics, and area dedicated to eucalyptus woodlots. The trader group is similarly heterogenous. Local village traders buy from tree growers and sell eucalyptus poles to traders in Merawi. Traders from Bahir Dar and other national markets source their products from Merawi to sell them to other traders or retail to consumer markets.

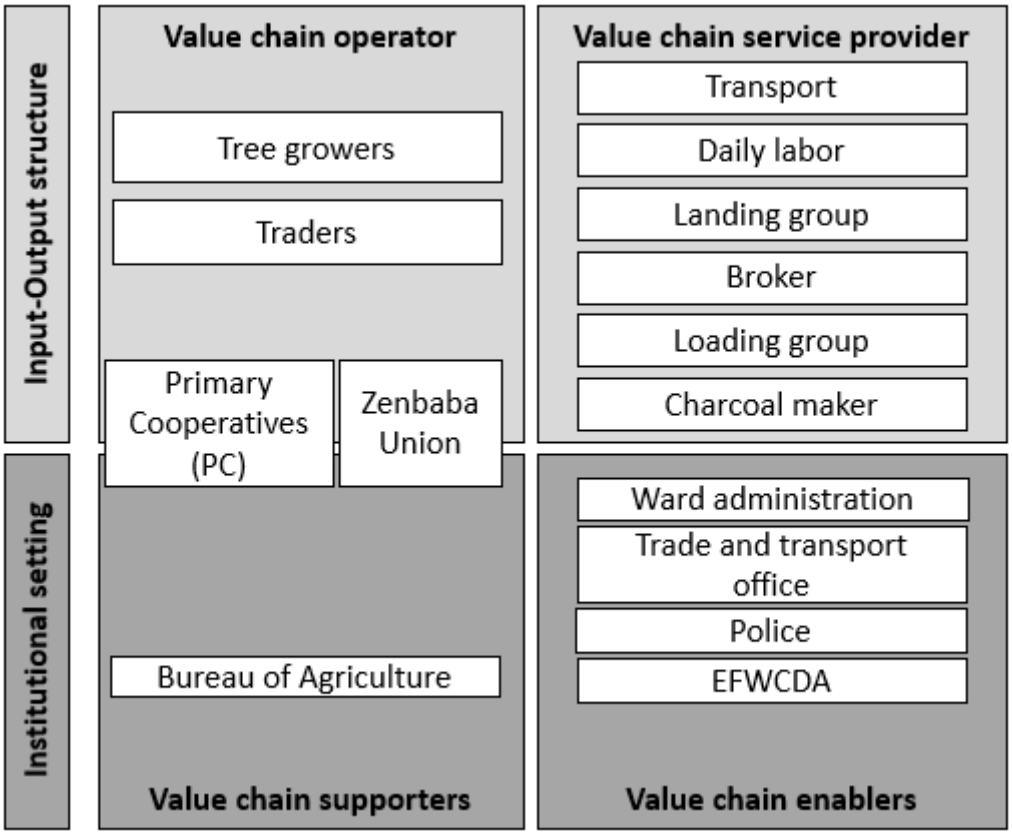


Figure 11: Actor groups in the eucalyptus pole value chain

Service providers within the input-output structure are transporters, daily laborers, landing groups, brokers, loading groups, and charcoal makers. Tree growers and traders hire daily laborers for harvesting operations. At the woodlot, locally organized loading groups will load the poles. Transport service providers are hired to transport poles from the woodlot to the landing site in Merawi and from there to the end markets. At the landing site in Merawi and Bahir Dar, organized groups referred to as landing groups do all labor tasks and receive payment from the traders. Charcoal makers will process residues at the landing sites in Merawi to charcoal for the traders. The task of brokers is to facilitate transactions.

Acting as enablers are the governmental organizations. These organizations are the ward (kebele) administration, the customs office, the trade and transport office, the police, and the Environment, Forest and Wildlife Conservation and Development Authority (EFWCDA). Traders using landings in Bahir Dar and Merawi pay land rent to the ward administration. In Merawi, the customs office, the trade and transport office, and the EFWCDA issue licenses for trading eucalyptus. The EFWCDA's task is to estimate the availability of eucalyptus resources in Mecha district based on which the trade and transport office will issue the trade licenses. Furthermore, the EFWCDA provides transport permits to traders. The ward and district police will check transport permits at the checkpoints on road No. 3.

The Bureau of Agriculture (BOA) was acting as a value chain supporter offering training to tree growers. Taking a dual position between value chain operator and value chain supporter are the Primary Cooperatives (PC) and the union of PC called Zenbaba Union. On the one hand, they provide support to tree growers as training on marketing and woodlot management. On the other hand, they are active in the chain as operators buying poles from their members and selling them to traders, but so far PC members prefer to sell directly to traders themselves, without the involvement of the PC or union.

4.1.5 Spatial flow and markets of eucalyptus poles

Eucalyptus poles flow from the production area in Mecha district to the district capital, Merawi, from where they are traded to Bahir Dar and other national markets like Gondar and Mekele as well as to the export markets in Sudan and Eritrea. The spatial flow from the production area in Mecha district to the markets is presented in Figure 12. The study scope is on the production area in Mecha district and the flow of poles to Bahir Dar.

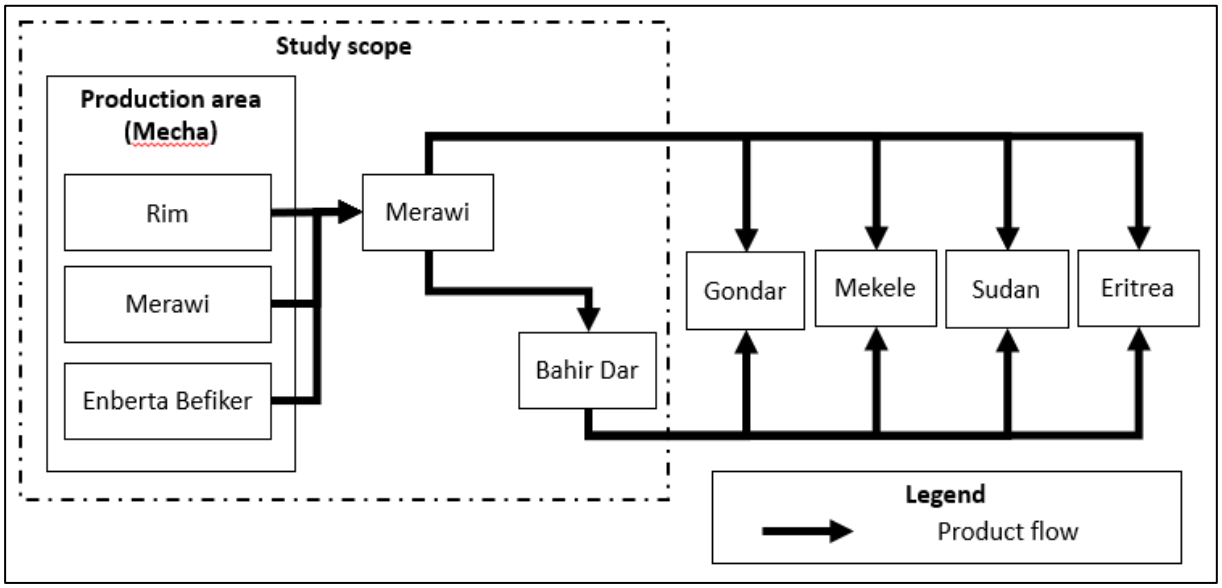


Figure 12: Spatial flow and markets of eucalyptus poles

Following the flow of eucalyptus poles from the production area, the starting point is the tree grower's woodlot. PC members from Emberta Befiker state that *"poles go up to Merawi and from Merawi it can go anywhere"* (ID-6). Similarly, a former village trader (ID-12) explained that he was selling to traders in Merawi.

Around the production area, several traders are active in the eucalyptus pole market buying poles from tree growers. PC members estimated about 30 traders around Enberta Befiker and about 8 traders around Rim.

From the production area, eucalyptus poles went to Merawi, where they are retailed to consumers, but most of the poles continued to other end markets. Members of Birhan Alem PC located close to Merawi explained that there are two market outlets from Merawi, which are the export to Sudan over Metema and Bahir Dar. Traders from Merawi confirmed the end markets and added the cities of Woldiya and Sokota. Traders and landing groups in Bahir Dar confirm that most eucalyptus poles come from Merawi.

The landing sites of traders were in and outside of Merawi close to road No. 3. A trader reported that there are about 10 individuals active at the landing site. Market activities take place throughout the year, but most timber is marketed from September to December; during the rainy season, it goes down due to road conditions and issues with molding poles.

Reaching Bahir Dar, eucalyptus poles went to numerous landing sites within the city and on its borders. Multiple traders were active on the landing sites. Traders in Bahir Dar explained that the poles are retailed to consumers in Bahir Dar as well as sold to traders who take the products to other national or export markets.

Spatial flow of charcoal

In contrast to the spatial flow of poles and fuelwood, charcoal value chain functions differently (see Figure 13). Charcoal is made in two locations. PC members in Enberta Befiker explained that they produce charcoal from the harvest residues at the woodlot. In addition, traders in Merawi hire charcoal makers to process leftovers from cross cutting or crooked poles. No charcoal production could be observed at the landings in Bahir Dar, nor was it mentioned by any of the traders or landing site workers. PC members of Enberta Befiker point out that their charcoal production is directly taken to Bahir Dar and that there are about 5 charcoal traders active in the area. Charcoal makers in Merawi mention Addis Ababa, Mekelle and Hawassa as further end markets. The reason for such distant marketplaces being the lack of timber sources around those areas.

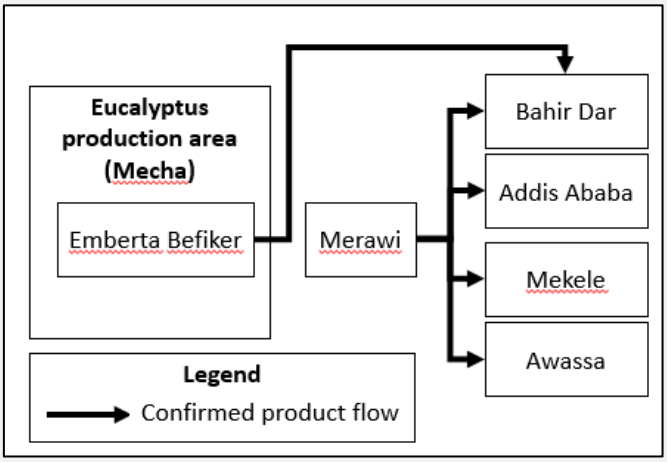


Figure 13: Spatial flow of charcoal

4.1.6 Transactions amongst value chain operators

The results of the study show that the chain consists of essentially two types of interactions amongst the chain operators – tree growers and traders as well as amongst traders. Tree growers and traders will interact either through standing or roadside sales.

In standing sale, the whole woodlot is sold to a trader who will oversee all the following stages. To determine the value of the stand the tree grower and trader will do a stand valuation separately. After bargaining, they will agree on a final price.

For this transaction, a contract is signed with witnesses and is enforceable as reported by a member of Meseret Hiot PC (ID-12). He further elaborates that with the signing of the contract the tree grower receives a small part of the final payment in case that the trader retreats. At the same time the tree grower must repay the trader should he sell the woodlot to another trader. A trader from Merawi (ID-17) confirmed that contracts are used which also gives the traders protection from tree growers retreating

from the contract by selling the woodlot to another trader. The final payment is done in cash during the loading of the poles.

For roadside sales, the tree grower will sell harvested poles to the trader. The two parties classify the poles, count the number of poles, and agree on prices per pole class. In both types of interactions, no additional information besides the price is exchanged (ID-12 and ID-8).

Interactions between traders appear in two ways. In general, traders will offer their products at landing site and will sell to any other trader based on price both at Merawi and Bahir Dar. In addition, some traders in Merawi explained that they have stronger ties to a partner at the national or export level. They will provide the poles to their partner and receive their payment once the poles are sold for example at Gondar, Mekele, or Metema (ID-17 and ID-10). The payment is done by bank transfer and no contract is used. The trader from Merawi explains:

> *"[…] we agreed that with my customer [partner] I may not cheat him, he may not cheat me, just we are working on respect." (ID-17)*

4.1.7 Market channels for eucalyptus poles

A total of 11 different market channels are possible based on the type of channel and end markets encountered (see Table 7). Wholesale is the main type which includes the standing or roadside transaction between tree grower and trader. The only direct channel for tree growers is to sell to the village market, which only takes a low number of poles but provides the highest per pole returns. The preferred channel for tree growers is wholesale. Tree growers at Birhan Alem PC pointed out that standing sale is their preferred way of selling as the traders will do the harvest. At the same time roadside sale is seen to provide higher income as they explain:

> *"The way, selling as standing forest is better. But for value-adding it is better to sell after harvest, to increase income. For easy management for us, it is better to sell standing trees. Selling standing trees is better than harvesting for them. Income is better selling harvested." ID-8*

For the GVC analysis, the wholesale channel to Bahir Dar with the lowest number of actors is selected. As explained by tree growers they generally prefer standing over roadside sales, and from a chain perspective, the chain with the lowest number of operators should be the most efficient.

Table 7: Market channels in the eucalyptus pole value chain

Channel						
Type	**End market**	**Actor 1**	**Actor 2**	**Actor 3**	**Actor 4**	**Actor 5**
Wholesale	**Bahir Dar**	Tree grower	Merawi trader	Bahir Dar trader		
		Tree grower	Village trader	Merawi trader	Bahir Dar trader	
Wholesale	**Merawi**	Tree grower	Village trader	Merawi trader		
Direct retail	**Merawi**	Tree grower				
	Village	Tree grower				
Wholesale	**National**	Tree grower	Merawi trader	Other		
		Tree grower	Village trader	Merawi trader	Other	
		Tree grower	Village trader	Merawi trader	Bahir Dar trader	Other
Wholesale	**Export**	Tree grower	Merawi trader	Exporter		
		Tree grower	Village trader	Merawi trader	Exporter	
		Tree grower	Village trader	Merawi trader	Bahir Dar trader	Exporter

Out of the three options to sell, tree growers prefer the standing sell over roadside sell. Tree growers at Birhan Alem PC pointed out that standing sale is their preferred way of selling as the traders will do the harvest. At the same time, roadside sale is seen to provide higher income.

Tree growers from Meseret Hiot PC explained that they will first ask for price offers for standing but if the offers are too low, they will sell at the roadside. They see the roadside sale as beneficial because the tree growers keep the small poles from the preharvest as well as other harvest residues.

> *"After harvesting is better for farmers. They will get branches, bark, and leftovers. If they sell standing, they will not get the remaining products." ID-13"*

Selective selling seems to be the least chosen approach. The only female tree grower interviewed had been harvesting single poles and selling them directly to local customers, in her case an individual constructing a house. She pointed out that in the future she wants to harvest all eucalyptus trees at once to make a bigger amount of income.

4.2 Description of actors at the input-output structure

The following three sections present the chain operators, which are the smallholder tree growers and traders, as well as the service providers.

4.2.1 Smallholder tree grower

Smallholders started to plant eucalyptus for subsistence but with increasing market demand income generation become the main target. This motivation for engaging in the eucalyptus value chain is shared by all interviewed smallholders. They pointed out that growing eucalyptus has become a common practice in their wards. The motivation to shift from subsistence to market-driven eucalyptus growing is best summarized by a member of Birhan-Alem PC:

> *"Initially I was interested to establish eucalyptus for the fuelwood consumption and to get construction poles. Later, the market became very good, so I switch to produce for the market."ID-8*

Furthermore, PC members reported that growing eucalyptus provides better financial returns than agricultural crops and thereby has improved smallholders lives as quote:

> *"Many people have improved their lifestyle by growing eucalyptus, for example, they are building houses in the town. "ID-12*

4.2.1.1 Activities carried out by smallholder tree growers

The activities that tree growers perform depend on their marketing choice. Smallholders have three options to market their eucalyptus. Standing sale, roadside sale, and selective pole sale (see Figure 14). Accordingly, they engage in one, two, or all functional stages of the chain.

In standing sale, they will sell the whole woodlot to a trader who will organize all the following functional stages starting with the harvest. In roadside sales, smallholders will organize the harvest and the transport of poles to a suitable landing site for transport by truck or mule cart by the trader. In selective pole sale, tree growers harvest single poles and sell them directly to a local consumer.

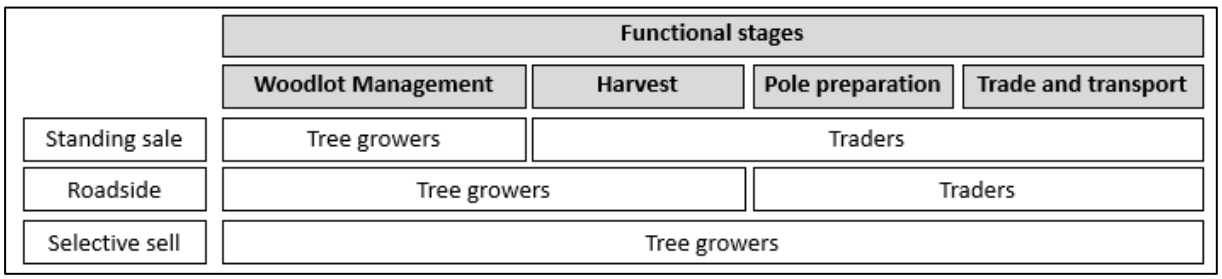


Figure 14: Smallholders' marketing choices

To describe the tree growers' activities three internal stages were created: input, woodlot management, and output (see Table 8). At the input stage, two different options exist, purchasing seedlings or purchasing material for producing seedlings. The interviewed tree growers explained that they produced potted seedlings and only needed to purchase materials for it. A chain expert adds that seedlings are also purchased from nurseries.

Inputs for potted seedling production are polyethylene tubes (plastic tubes) and seeds. In the interviews with PC Meseret Hiot and Birhan Alem, tree growers explained that they purchase the plastic tubes from shops but collect the seeds for free. Furthermore, they collect wood ash as fertilizer for seedling production and if available purchase chemical fertilizer for stand establishment.

Table 8: Smallholders' activities

Input	**Woodlot management**	**Output**
Buying inputs	Seedling production	Stand valuation
	Woodlot establishment	Contacting buyers
	Weeding	Price negotiation
	Forest protection	Harvest

Woodlot management consists of four activities: "seedling production", "woodlot establishment", "weeding" and "forest protection". For seedling production, tree growers mix sand, local soil, and compost and fill the polyethylene tubes. Seeds are collected from mature trees as the germination percentage is high and seeds from young trees do not germinate.

Issues with seedling production point out by tree growers are water availability and protection. As smallholders explain seedling production needs water therefore seedlings should be raised close to a water source, but simultaneously mature seedlings are often stolen if they are not properly protected. Therefore, they need to produce the seedling at home for protection, which causes the transportation of water. Transporting 2,500 seedlings to the planting site is hard work. Furthermore, transportation damages reduced the seedling survival rate. Some of these issues were mitigated by shifting from bare-root seedlings to the use of potted seedlings, which according to the tree growers have higher survival rates and are more resilient.

For the woodlot establishment, the land is plowed 5 to 6 times followed by intense weeding and fencing to protect seedlings from grazing animals. A tree grower from PC Rim explains that for establishing his woodlot he planted the seedlings with corn and used chemical fertilizer, which benefited both the growth of corn and eucalyptus seedlings. Weeding during establishment is done to keep down competing vegetation.

Young woodlots are protected from free-grazing animals by fencing. The grazing issue has improved with a general grazing ban and a shift to feeding cattle at the homestead (cut and carry system). Further issues reported with little option for protection are termites, cold temperature for young seedlings, other insects, and disease.

At the output end, the activities depend on the three marketing options. In general, the marketing starts with either the tree grower being contacted by a trader or with the tree grower's decision to sell his woodlot. Choosing between selling standing or roadside is based on the price as PC members explain. The three marketing options are presented separately.

In the standing sale, the tree grower will do a stand valuation to determine his sales prices. The final price consists of two components: the estimated value of the stand and a bargaining margin, as pointed out by marketing expert of Tiret Lediget PC:

> *"If pole or forest land cost about 30,000 ETB they can add up to 35,000ETB [5000 added]. This is an example. This may be the normal price." ID-6*

As well as by members of Birhan Alem PC:

> *"Generally, if pole cost is 20,000 ETB, we add 2,000 ETB. In total 22,000 ETB. After negotiation they might meet [trader and seller] at 20,000 ETB. The markup for bargain is an estimation from the seller. We add some amount of money." ID-8*

The stand value is determined by counting all the trees according to the local pole classification which can have 3 to 4 classes based on diameter. A tree grower explains:

> *"First, they count only kench [pole class]. They mark the trees to avoid duplicating. After kench, they start worage [pole class], after that, they count the other. For four levels it takes two individuals about 6 h for 0.25 ha." ID-8*

The counted number of trees per pole class is multiplied by the local market price for that pole class. The products per class are summed up and divided by the total number of poles to reach an average weight price per pole. The prices used at Birhan Alem PC, the PC nearest to Merawi town, are kench – 20 to 30 ETB, worage – 18 ETB, mager – 17 ETB and smaller mager – 16 ETB. This is described by tree grower:

> *"He will count the trees into different levels. After counting he will generate a price per level. Levels are kench, worage and mager. He counts the three levels separately and gives the price for each separately. He sums the value and creates an average per pole." ID-8*

After the interview with the PC members of Birhan Alem (ID-8), one of their woodlots was visited to better understand the classification of eucalyptus trees. For several trees, the BHD was measured, and the PC member gave their estimated pole class (see Table 9). The anecdotal result shows that the estimation is somewhat accurate but at least 2 out of 12 were estimated wrongly.

Table 9: Tree grower estimation of pole classes at the woodlot

Category estimated by tree grower	**BHD measured (cm)**	**Diameter based on classification (cm)**
Kench	15, 14, ***11***	>12
Worage	10, 11	10
Mager (big)	9, 7, 9.5, ***10***, 8	8
Mager (small)	6.5, 4.5	8

In contrast, the tree growers interviewed at Enberta Befiker PC appear to use only price estimation for stand valuation as explained by a member:

> *"I estimated my plantation, it can be estimated to 29,000 ETB. This is a simple estimation. Traditionally, [I] know how to estimate the area. By estimation, the plantation should be valued at up to 29,000 ETB. No total count." ID-18*

Once the price is determined several buyers are contacted to give an offer. A tree grower said:

> *"We ask more than 3 to 4 middlemen [trader]". ID-8*

If the offer is above the tree growers' sales price, he will sell, if the buying price is within the bargaining margin, tree growers might reduce the price but if the price is below the stand valuation, tree growers will not sell as explained by a smallholder tree grower:

> *"[… the price might be 32.500ETB] if this is real, I will add some cost, adding 8,000 ETB. If middlemen pay this, we [sellers] say welcome and we will take it. otherwise, if middlemen come with below this amount [32.500 ETB] we will never sell." ID-18*

In roadside sales, no stand valuation is needed as the price is negotiated later with the trader. Tree growers of the PC's Meseret Hiot and Enberta Befiker explained the process for roadside sale. The harvest starts by clearing all small-sized poles which will be used for fuelwood. Afterward, the commercial poles are harvested (kench, worage, and mager) and bigger ones are left standing for later processing to split wood (filt). The trees are debranched, debarked, and transported to a temporal landing site. At the landing, the trader and tree grower will negotiate. The process is best summarized by a tree grower from Meseret Hiot PC:

"First we clear the forest land. Clearing means getting the small-sized poles for fuelwood. Afterward, they continue with felling trees except for big trees for splitting [filt]. Mager, worage, and kench are harvested. Lastly, big trees for splitting are cut. After clear-cutting poles are transported to the road and piled separately in three levels Kench, worage, and mager. After that, he will negotiate with middlemen." ID-12

For harvesting tree growers will hire daily laborers who receive 2 ETB/pole for felling, debarking, and piling at the woodlot. The transport to a temporal landing is done either manually for short distances costing 1 ETB/pole or by mule cart costing 1.5 to 2 ETB/pole. The temporal landing is located at a location for better transport by trucks. In the dry season, trucks can cross agricultural land. In addition, tree growers might need to pay for guarding the poles.

The price negotiation can be done over the phone. Selling roadside prices for poles might be 2 to 3 ETB higher than in standing sales. For the case of Meseret Hiot PC at Rim village, the estimated prices for roadside are kench - 40 ETB, worage – 33 ETB, mager – 15 ETB, and filt – 30 ETB.

In contrast, the tree growers at the Enberta Befiker PC cut the poles to approximately 7 m in length and use the treetops for charcoal making. Furthermore, at the temporal landing, they put samples for each pole class with the trader. The trader will only buy the poles they have agreed. The price per classification is determined. Price examples were kench – 37 ETB, worage – 37 ETB, and mager – 18 ETB.

Selective sell is done if a tree grower sells to the local market. In that case, they can negotiate a higher price compared to wholesale but only sell a limited amount. Customers are usually individuals who are constructing houses. Prices for Enberta Befiker worage 50 ETB, mager - 25 ETB, small mager/kristi – 28 ETB.

4.2.1.2 Smallholder tree growers' resources

The actor group of smallholder tree growers was found to be heterogeneous group due to differences in available resources. Tree growers' most important physical capital is the land for production. The land-use rights are granted by the government by long-term leases. Smallholders reported to own between 1.25 to 1.75 ha out of which 0.25 up to 1.125 ha are planted with eucalyptus and the remaining is used for agricultural production. PC members from Meseret-Hiot estimated that about 1,500 poles grow on 0.25 ha. Besides the differences in the size of the woodlot owned, the tree growers varied in their access to markets, due to their location related to the markets or the quality of the road infrastructure. For example, tree growers located far from the main market of Merawi often faced poor road infrastructure, which created issues for transporting poles efficiently.

Furthermore, the smallholder tree growers varied within their wealth status. Besides growing eucalyptus, most smallholders were engaged in agriculture and a few smallholders also had business such as shopkeeping, which provided a more profitable livelihood option compared to agriculture. However, the source for most of the heterogeneity amongst the smallholder tree growers was the differences in human capital which could be traced back to the education background, employment experience, and experience growing eucalyptus. For example, some tree growers had been working as district administrators, accountants, or traders which provided them with additional skills useful in the marketing of eucalyptus. To increase their human capital smallholders reported having participated in training targeted at eucalyptus growing. Improvements they had learned from these training events included from their point of view: shift to wider planting spacing of 1x1m for better pole production (ID-8 and ID-12); applying chemical fertilizer to increase seedling growth; cross cropping with agricultural products during woodlot establishment (ID-12 and ID-13); intensifying weeding (ID-12 and ID-13), and; organizing their woodlots in a rotation system for regular harvest (ID-12 and ID-13). In addition, the members of the three PCs reported having gathered experience with eucalyptus growing for about 10 to 20 years. In general, a regulator at the government administration (EFWCDA) pointed out that most of the farmers in Mecha were experienced with the management of eucalyptus woodlots.

Looking at the organizational capital tree growers shared information on their previous sales and prices with other tree growers. Horizontal interactions were an important source of information on the local market. The primary cooperatives also played an essential role as platforms for sharing information and conducting training, and hence was a place for a strong level of horizontal interaction

4.2.2 Traders

The group of traders was found to be heterogeneous, even though there are wholesale and retail licenses issued by the bureau of finance and trade. The licenses do not limit the trader to only whole selling or retailing, rather the wholesale license permits the trader to take products across district borders. Distinguishing between retailer or wholesaler is difficult as hinted by a cooperative member of Birhan Alem PC:

"Similar middlemen can make trading." ID-8

The differentiation of traders was based on their function in the value chain and their geographic location which resulted in 5 types of traders: village trader, Merawi trader, Bahir Dar trader, exporter, and other national traders (see value chain map Figure 7). Village level traders are the most local traders closest to the production area and tree grower. Merawi traders are the next group of traders, located at landing sites in Merawi and at road No. 3 close to Merawi (see map Figure 6). They buy from village-level traders or directly from tree growers and prepare poles for further trade. They retail the product to Merawi consumer market and sell it to traders from Bahir Dar or other national traders and exporters.

Traders in Bahir Dar buy construction poles or whole poles from Merawi and other production areas. They are located at landing sites in and around Bahir Dar mainly at road No. They retail to Bahir Dar market and sell to other national traders and exporters. Other national traders take constructions poles to national markets such as Gondar or Mekele. Exporters take the product to Metema where they sell the export poles to Sudanese traders.

4.2.2.1 Activities carried out by traders

The activities carried out by traders can be grouped into "input", "processing" and "output" (see Table 10).

Table 10: Traders' activities

Input	**Pole preparation**	**Output**
Contact grower/trader	Storage (sorting and pilling)	Contact to trader
Stand valuation and pricing	Crosscutting	Wholesale
Price negotiation and buying	Charcoal	Retail
Harvest and transport		
Transport and royalty		

Transactions between tree grower and trader were either direct or facilitated by a broker. Traders bought whole woodlots standing or harvested at roadside. The first step was to establish contact between the tree grower and trader. In the direct channel traders went around looking for mature stands and established contact to woodlot owners as expressed by a trader from Merawi:

> *"By rounding […] and watching the mature forest and asking the owner. Directly contact the owner to ask if he will sell the forest to him." ID-17*

Traders in Bahir Dar used brokers if they did not know the area of production or had no direct contact with tree growers, which was the case when woodlots are far away. Using a broker did not directly lead to tree growers receiving lower payments. The bargaining during price negotiations was found to be more important to the financial outcome of a transaction as explained by a trader in Bahir Dar:

> *"If I discuss with the farmer strongly, I can buy with even lower price. Sometimes also if I buy [with] a higher price, yes, they [tree growers] might be benefited. Even when farmers use brokers, they may get a higher price. He said it depends on the negotiation. Negotiating with farmers and negotiating with brokers." ID-5*

Buying standing is the most common approach for traders. The trader will do a stand valuation, estimate costs, and predict a sales price to make an offer to the tree grower. The stand valuation approach is very

similar to the tree growers' ones, but traders count only marketable trees as explained by the marketing expert at Tiret Lediget PC:

> *"Yes, they do have different counting systems. Traders only count trees that the trader can market. They never count as kench, worage and mager. They only count the valuable trees in different markets" ID-6*

The traders saw the negotiation with tree growers as difficult because tree growers are strong due to their market knowledge. Traders pointed out that tree growers *"are very active. […]. They know everything. It is difficult to negotiate. They are strong." ID-5*

Negotiation is a time-intensive activity, as a trader in Merawi explained *"Within one day [a mature stand can be found]. Negotiation can take more time." ID-17*

For roadside buying, traders did not need to do a stand valuation nor organize the harvest. A former trader pointed out that standing sale was better as the woodlot value is an estimation and he could make additional benefit from the estimation error. He explained:

> *"Standing [sale of] forest is an estimation and not accurate. After harvesting, you count accurately the poles, but standing trees are purchased by estimation. […]. After harvesting each will be controlled and counted." ID-13*

In standing sale, the trader had to organize the harvest, whereas in roadside his workload is reduced but the competition for harvest product is high. A trader commented:

> *"Already harvested, it reduces labor. Some [benefit]… for them. It is easy to purchase harvested products, but for harvested products competition is high between middlemen. Everybody needs to purchase harvested." ID-17*

For both standing and roadside, traders will have to organize the transport from the production area to Merawi town. The trader either has his truck or hires a transport service provider, as explained by a former trader and current member at Meseret-Hiot PC:

> *"Some middlemen have their own truck for transporting, some individuals [transport service provider] they are not middlemen, but they rent to other middlemen." ID-13*

At the landing site, traders will prepare poles for transport by crosscutting to length depending on the end market. For short distances to Bahir Dar, the poles are kept long but for long distances like Mekele or Metema the poles a shortened to optimal size to fill a truck with a trailer as told by a Merawi trader:

"Trees are crosscut to transport to Mekele or Metema to utilize truck with trailer. Poles for Bahir Dar, Woldiya, Sokota and Gondar are long." ID-7

The leftovers at the landing site in Merawi can be sold as fuelwood to the end market or processed into charcoal. The trader can choose to sell the leftovers to charcoal makers, or he can hire them to produce charcoal and sell it.

Traders in Merawi engage both in retail and wholesale as described by a trader in Merawi:

"We sell to retail and wholesale. If the middlemen buy all products, it is nice for us. Otherwise, we can also sell retail selling [piece by piece]." *ID-17*

The transport and royalty fee are covered by the buyer. The royalty fee varies by *"truck with trailer3000 ETB royalty, and truck without trailer paying 1600 ETB." ID-5*

Like the traders in Merawi, traders at landing sites in and around Bahir Dar engage in retail and wholesale. In contrast to Merawi, poles are sorted according to quality because poles of good quality have similar prices as the interview with a pole landing crew in Bahir Dar revealed:

"Yes, they are saying for kench, worage, and mager. They are piling together one pile [, because]it is the same cost [price]." ID-4

Issues that traders reported are the shrinking of poles due to drying which will reduce the diameter and thereby the value of the pole. Struggle to establish a business due to capital shortage. Ultimately, changes in the market can cause them to have losses.

4.2.2.2 Traders' resources

Physical resources needed by traders are financial capital and a landing site. Especially to enter the pole trading business traders need financial capital to purchase a trading license, rent a landing site, and buy eucalyptus poles. The starting of the business *"[…] was difficult due to capital shortage"* explained by a trader from Merawi, he expanded:

"Initially it was money limitation. I started with less amount of money. For that, it was difficult to create the business. Farmers do not sell on credit, sell without payment. That was my challenge." ID-17

Licenses are only provided to individuals who can prove sufficient capital. Licenses are available as retail and wholesale. For wholesale license, a trader needs to show: "[…] *up to 100,000 ETB."* ID-10. Retail licenses are cheaper but allow only for trading within the district, whereas the wholesale license allows the transport to other areas.

"Wholesalers, mostly taking from here to other areas. The retailer only sells around this area. This is the only reason." ID-10

In Merawi the licenses are issued through a process involving three government organizations and are issued based on resource availability in the district.

"There are three organizations. Custom office, trade and transport office, and the third one forest and environmental protection. These are integrated to issue the license." ID-10

"It is not opened. It is restricted based on the resources. The one who will get the license is determined. After taking many evaluations it is decided. Not everyone can get a license. It is based on resources availability." ID-10

A landing site can be rented by a trader, or he uses communal land for free. In Bahir Dar renting costs are at 6,500 ETB/a, and 500 ETB/a for land taxation. A trader in Merawi reports that he is required to pay 10,000 ETB/a. In contrast, a trader outside Merawi at road No.3 reports that he has no costs for the landing site as he is living in the ward and can use the communal land for free.

"[Yes], it free to everybody. It is communal land. It belongs to everyone. If you are living in this kebele [ward] he can use." ID-7

4.2.3 Service providers

Activities such as harvest, loading, transport, and handling of poles at pole landings are mainly done by service providers which are hired by tree growers or traders. The service providers are daily laborers, loading groups, transport providers, landing groups, and brokers (see Figure 11).

Traders and tree growers will hire daily laborers for harvest (about 2 ETB/pole) and locally organized groups will carry out the loading at the woodlot. For transport from woodlot to Merawi, traders can hire transport service providers which use either trucks or mule carts. The type of transport used varies based on accessibility, transport amounts, and distance. Accessibility is best during the dry season as trucks can drive across fields. If the pole number is not sufficient for a truckload, mule carts are used. For transporting poles from Merawi the distance is the key factor, as transports to *"Metema [… are] with trailer. For Bahir Dar they [traders] use Russia trucker. Double trailer is more effective."* (ID-8).

A mule cart can load about 80 mager or up to 40 kench poles. The transport costs vary between 3 to 6 ETB/pole depending on the distance, amount, and pole class. The truck price is based only on distance and can load between 450 to 600 poles depending on pole size. The trucking cost from Enberta Befiker PC area to Bahir Dar is about 2,000 ETB/truck and to Merawi about 1,500 ETB/truck; from Rim (Meseret Hiot PC) to Merawi about 2,000 to 2,200 ETB/truck.

Brokers are active between tree growers and traders (Merawi and possibly Bahir Dar). Brokers are paid a commission by trader 0.5 to 1 ETB per pole. Working as a broker is a side income for smallholders but their business has a negative image as expressed by a chain expert as:

> *"Brokers are mostly farmers. Brokers are not respected. Brokers can work with different middlemen. He gets different income from middlemen." ID-1*

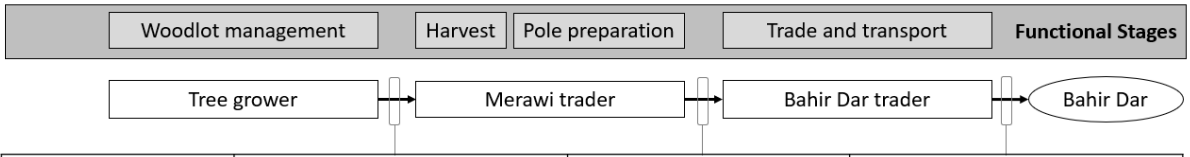
Furthermore, brokers also facilitate transactions between traders, as a trader from Merawi explained that traders either contact them directly or a broker will establish the contact.

4.3 Value chain governance and intervention targets

The results presented in the following two sections are dedicated to objective 2: to analyze the GVC governance form for each transaction in the selected marketing channel and to provide targets for interventions to improve the transfer of market knowledge.

4.3.1 QVC governance

For the analysis of the GVC governance, the marketing channel with the lowest number of actors leading to the Bahir Dar end market was selected (see Figure 15). In summary, tree growers sold eucalyptus products either as standing or roadside sales to Merawi traders who sold the eucalyptus poles to Bahir Dar traders. In Bahir Dar the traders retailed to the consumer market. Standing and roadside sales are analyzed separately, resulting in 4 transactions to be analyzed. Figure 15 presents the GVC governances forms for each transaction and the underlying scores of the three factors.



	Tree grower to Merawi trader		Merawi trader to Bahir Dar trader	Bahir Dar trader to consumer
	Standing	Roadside		
Complexity	High	Low	Low	Low
Codification	Low	High	High	High
Capabilities	High	High	High	High
GVC governance	Relational	Market	Market	Market

Figure 15: GVC governance in the eucalyptus value chain

(1) In standing sale, the traders in Merawi buy whole woodlots from the tree growers. The product is seen as complex, both regarding the product and interaction occurring. A woodlot of 0.25 ha consists of at least 1,500 stems up to 15 m in length with varying diameter and quality, requiring an inventory of the woodlot to determine how many commercial products are subject to the transaction. Therefore, both tree grower and trader need to do a stand valuation before negotiating a price, increasing the steps in the transaction.

For the stand valuation tree growers use the local pole classification system which is based on diameter estimation. The codifiability of the woodlot with the local standard is assessed as low. The local standard is primarily for harvested debranched eucalyptus poles with a length of 5.5 to 9 m and not for stems of 15 m length and branches. This causes 6 to 9.5 m per stem to not be included in the valuation.

The capabilities of the tree growers to meet buyers' requirements are seen as high. The interviews have shown that tree growers are capable to produce eucalyptus woodlots, as they have the required resources of land and knowledge on woodlot management. In addition, tree growers know how to engage with the traders and can maintain a transaction. Furthermore, they use bargaining markups and offer their stand to several traders to compete for the price. The description of tree growers' activities shows that they apply a systematic approach to inventory their woodlot by counting the stems according to pole class. Through their horizontal interaction with other tree growers, they receive pole prices in their location.

The standing sale transaction between tree grower and Merawi trader falls within the relational value chain governance as complexity and capability score is high and codifiability is low.

(2) In roadside sales, traders will buy harvested eucalyptus poles from tree growers. The complexity is assessed as low because harvested poles in comparison to a whole woodlot are easier to quantify and classify. In contrast, the complexity of transactions could be seen as higher, because tree growers must organize the harvest. To summarize, buyers' requirement is harvested poles which have low complexity regarding the product specifications but increasing complexity to engage in a transaction. Nevertheless, the complexity is seen as low.

The codifiability of harvested poles is scored as high. Harvested stems are crosscut to *"measure up to 7 m [in] length"* (ID-18) as explained by a tree grower from Enberta Befiker PC. The local standard for poles between 5.5 to 9 m fits harvested poles of 7 m in length but still allows for inaccuracy. The quantification of poles is precise as the poles can be counted both by tree grower and trader. Concerning the standing sale, the codifiability of roadside sale is high.

The capabilities in the supply base regarding roadside requirements are well developed. Tree growers can use the local standard to classify their poles and have knowledge of the prices per pole class. The actors can negotiate the price at the woodlot giving them the opportunity to exactly determine pole classes, prices, and number of poles. The transaction requires tree growers to harvest the poles and to transport the poles to a temporal landing from where poles can ideally be transported by truck to the landing sites in Merawi. The interviews with tree growers show that they have a systematic approach to harvesting their woodlots. In addition, they keep harvest residues which they can utilize themselves or sell as fuelwood or charcoal. Capabilities to produce and harvest eucalyptus poles are not lacking. To summarize, the capabilities can be assessed as high.

The roadside transaction falls within the market governance form. According to GVC theory roadside sale is governed by the market and should exhibit low power asymmetry and explicit coordination. Price and product specifications are key elements for the transaction.

(3) Turning to the transaction between traders, the study found that traders from Bahir Dar will buy poles from traders in Merawi through wholesale. Buyers' requirements are low. The minimum requirement is at least a truckload of poles, which is between 500 to 600 poles. The transacted product is construction poles, in this case between 7 and 9 m length as traders and tree growers explained that poles going to Bahir Dar are kept long. As such the complexity of the transaction is low.

The transaction between traders is based on the number of poles and the average price per pole. For the sale to Bahir Dar, poles are not classified. Traders in Merawi will sort out crooked and short poles which can be sold as fuelwood or processed to charcoal.

Traders in Merawi are capable to meet buyers' requirements. They know their average buying prices and costs to determine a sales price. To be able to participate in the transaction traders in Merawi require access to a landing site for storage and location from where they can sell. Furthermore, at least a retail license is needed. All in all, Merawi traders' capability is high.

The transaction between traders falls within the market governance form, therefore price and product specifications are key elements for transactions.

(4) At the final transaction at Bahir Dar, the consumers' requirements shape the transaction. Traders in Bahir Dar offer poles according to quality and put their prices accordingly. Consequently, customers appear to have certain quality requirements. No further requirements could be identified, keeping the complexity low, which makes the codifiability high as poles can be sold based on the estimated quality which is based on straightness. Sorting poles and negotiating a price with the buyer are the capabilities needed. No processing is required. Consequently, it appears the clearest case of market governance in the chain.

4.3.2 Targets for intervention

Stepping back and looking at all four transactions some tendencies become apparent. Comparing the complexities of the transaction, the standing sale is the most complex transaction followed by a roadside sale. Getting closer to the consumer market transactions become less complex. In addition, standards become more precise towards the end of the chain increasing the codifiability.

Furthermore, the standards used in the production area vary from those at the consumer markets. Eucalyptus poles in Mecha district are grouped according to diameter class, but at the consumer market in Bahir Dar the poles are sorted by quality independent of their diameter because consumers pay higher prices for straight poles. This appears as a significant barrier to the communication of market information. The standard used to group poles in Mecha district does not use quality as a specification, whereas this is the key value driver in the consumer market. It becomes even more significant as the value chain does not include any processing. The value addition is solely based on the delivery to the final market.

Besides the more precise classification of poles towards the end market, the quantification behaves in the same way. For standing sale, the codification of the transacted quantity has the highest inaccuracies in the chain, causing a significant undervaluation of the stand due to underestimating the quantity. This impacts especially the tree growers at the start of the value chain and less the traders in the chain.

The targets for intervention should be to improve the standards used to classify and quantify the transaction. Regarding quantification, the base unit of one pole is too ambiguous as it can vary from 5 to 9 m in length. Likewise, the classification should be based on the preferences of the consumer market, which are straight eucalyptus poles.

5 Discussion and conclusion

Before discussing the results, the first section establishes the boundaries of the validity and reliability of the results. Each key finding on the eucalyptus pole value chain and intervention targets are presented in separate sections.

5.1 Validity and reliability of the study results

The description and especially the information used for the analyses had to be condensed. The study took the approach to focus on the best cases found. This was done because it is an underlying assumption in the GVC theory. Gereffi et al. (2005) state that low supplier capabilities paired with low complexity and high codifiability means that suppliers are excluded from the chain. In the case at hand tree growers who are not able to grow sufficient poles are excluded from wholesale marketing channels. The results of this study should be seen in the light of the best-case scenario, but to how many smallholder tree growers this scenario applies cannot be determined.

In addition, to assure the reliability of the results, the study findings were triangulated and direct quotes from the interviews were included in the results to provide a better understanding of the context and a strong link between the interviews and the results.

5.2 Eucalyptus pole product and its standardization

The objective was to map the eucalyptus pole value chain from production by smallholder tree growers in Mecha district to the final market in Bahir Dar city. Several eucalyptus products were encountered and grouped into commercial and non-commercial products. The key commercial products were construction poles, fuelwood, and charcoal, which have been identified in other recent value chain studies in Ethiopia (Barbiche and Alemu 2016; Tsedalu 2017; Munuyee 2018).

The study found that there were three main constraints related to the eucalyptus pole standardization. Firstly, the base unit to quantify eucalyptus poles was one pole, which resulted to be imprecise because the length of one pole was not unified. Based on the conducted interviews one pole was approximately 7 m long but the length could vary between a minimum of 5.5 m up to at least 9 m of length. The report from Barbiche and Alemu (2016) and study from Tsedalu (2016) come to the same result.

Secondly, as found by previous studies across Ethiopia (Barbiche and Alemu 2016; Tsedalu 2017; Munuyee 2018), also in this study area a diameter-based classification system was used for different qualities of eucalyptus poles. However, the diameter was estimated and not measured. Thirdly, the terminology and diameter classes for the different qualities of the poles varied even within a small area. Hence, even though the local pole classification system was widely used and accepted, it did not meet the requirements of a standard as put forward by Gereffi et al. (2005). All these three standardization constraints caused a high level of impreciseness and space for a high variation on the price received for

the same quantity or quality of pole. The low standardization also greatly impacted how the eucalyptus pole value chain was governed and is further discussed in section 5.7.

Standardization of eucalyptus products should be a key target to improve the transparency in the eucalyptus pole value chain. Before establishing better standards, a study focusing solely on the current standardization practices in the chain should be conducted involving all the smallholder tree growers in a particular area because they are the actor group expected to benefit most from greater transparency in the chain. In addition, practices from eucalyptus value chains originating from industrial plantations could be further explored and utilized for smallholder eucalyptus pole standardization, based on the assumption that within those chains the capabilities regarding standardization are already developed.

Furthermore, a suitable actor needs to be identified for driving and ensure standardization. As Gereffi et al. (2005) point out that standardization is done by lead firms or other private or institutional actors. Based on the current chain studies, no clear lead firm is dominating the eucalyptus pole value chain, therefore it is more likely that a suitable actor is rather found within the institutional setting. Malinen et al. (2015) provide a good insight into standardization and pricing mechanisms in northern European Scots pine roundwood markets in which standards are managed by timber grading associations consisting of sellers and buyers.

5.3 Eucalyptus pole markets and opportunities for market niche development

In the studied eucalyptus pole value chain, the production of eucalyptus poles starts in the district of Mecha by smallholder tree growers who grow eucalyptus woodlots commercially for income generation. The minimum growing period is 5 years. The smallholder tree growers sell the whole woodlot or harvested poles (standing and roadside) to traders who take the product to the district capital Merawi which is the important intermediate market. Traders in Merawi sell eucalyptus poles at landing sites to traders from Bahir Dar or other cities in Ethiopia as well as to exporters who take the product to the border town of Metema for export to Sudan (see spatial flow and actors in Figure 7).

In contrast to other eucalyptus value chains analyzed in Ethiopia (Tsedalu 2017; Munuyee 2018), the geographic extent of the chain reaching export markets is unique. Exporting of goods is important for Ethiopia on a macroeconomic scale as it brings foreign currency (dollars) into the country which is needed for investments. Opening a direct marketing channel for smallholders to benefit from exporting eucalyptus poles appears as an attractive new market channel. Nevertheless, smallholders as individuals lack the capabilities to expand their activities to the export of poles.

In line with the conceptual framework, horizontal cooperation amongst smallholders in form of cooperatives could create a good supply base for exporting (Trienekens 2012). As this study found, in Amhara primary cooperatives and a union are active in supporting tree growers, which is unique as these cooperative organizations so far have not been encountered in eucalyptus pole value chains in other

regions of Ethiopia (Barbiche and Alemu 2016; Tsedalu 2017; Munuyee 2018). Based on this study's results the primary impact of PC and union has been in training and knowledge exchange. Focusing a study on the capabilities required to enter export markets through a cooperative structure could uncover a further option to increase the value reaching smallholder tree growers.

Within the national markets, further potential exists as this study discovered a niche market for big diameter poles for sawmilling in Bahir Dar. Eucalyptus' sawmilling is not a common practice in Ethiopia but in Uganda, it is an integral part of the eucalyptus pole value chain from smallholder woodlots (Abdul 2020). Sawmilling could add processing to the value chain, open new market segments, and thereby bring more value to the chain. The topic of eucalyptus sawmilling in Ethiopia has not been studied so far, but it could become a key step for developing more processing in the chain increasing value-addition.

5.4 Functional stages in the eucalyptus pole value chain

The value chain consists of four functional stages which are woodlot management, harvest, pole preparation, and the final stage of trade and transport. The first stage of woodlot management is in the hands of smallholder tree growers, whereas the remaining three stages are dominated by traders. This division is common within the value chains in Ethiopia (Tsedalu 2017; Munuyee 2018).

In Munuyee's thesis (2018) the stage including harvest activities was termed "processing". In contrast in this study, the stage is called "harvest" as poles are not processed at any stage of the chain. During harvest, there is some manual labor like debranching, debarking, and crosscutting to length but nothing comparable to the processing in Uganda where eucalyptus poles are used for sawmilling (Abdul 2020).

5.5 Key transactions in the eucalyptus pole value chain

There are two types of vertical interactions in the wholesale market channels – tree growers to trader and trader to trader. Tree growers and traders interact either through standing or roadside sales. In addition, transactions can be facilitated by brokers in cases that the transaction partner is distant from each other or knowledge about suppliers or buyers is not available. Standing sale and selective selling have been previously identified as marketing options for tree growers (Tsedalu 2017; Munuyee 2018). The option of roadside sale was previously identified by Barbiche and Alemu (2016) and provides the tree growers with an additional option to enter the eucalyptus pole value chain. Thanks to three options to market eucalyptus poles, tree growers' bargaining position was strengthened as they can choose from the three options depending on the market environment.

The interactions between traders remain obscure. As known from the previous description of the value chain in Amhara (Barbiche and Alemu 2016), traders will offer their products at landing sites at Merawi and Bahir Dar and sell to any other trader. The current study found some traders have established vertical relationships based on trust. The trader will provide products without upfront payment and trust that

once their partner has sold the poles at the destination, they will receive their payment. This can be seen as an option to overcome capital shortages through the cooperation of traders at the input-output structure. Nevertheless, it is unclear if this is a general practice.

5.6 Capabilities of tree growers and traders

Tree growers' activities are either about woodlot management or marketing of their products. Woodlot management includes activities such as seedling production, woodlot establishment, weeding, and forest protection. For marketing, tree growers must evaluate their products and establish prices. Furthermore, they can initiate the transaction by contacting traders. For roadside sales, they will have to organize the harvest of their stand.

Tree growers' most important physical capital is the land on which they grow their woodlots. Smallholders reported to own between 1.25 to 1.75 ha out of which 0.25 up to 1.125 ha are planted with eucalyptus and the remaining is used for agricultural production. Contrasting landholding size and woodlot sizes to values reported in other studies, it seems that tree growers in Mecha district dedicate more land to tree-growing. Tsedalu (2017) found that tree growers have on average 1.25 ha land of which 0.1 to 1.25 ha are dedicated to woodlots and Munuyee (2018) found that landholdings from 0.2 to 4 ha out of which 0.1 to 1.25 ha are dedicated to woodlots. Nevertheless, the underlying data in this study is anecdotal, but dedicating more land to eucalyptus poles shows that smallholders in Mecha are expecting higher returns from growing eucalyptus than from agriculture.

Human capital varies amongst tree growers due to education background, employment experience, and experience growing eucalyptus. Knowledge on tree growing and marketing appears to be developed as tree growers showed that they are actively participating in the chain. Furthermore, human capital has been increased through training provided by chain supporters on woodlot management and marketing.

Tree growers have developed tactics to improve their bargaining position in the price negotiation. In the price for a woodlot, they add a bargaining margin. Furthermore, they will offer the woodlot to several traders and thereby benefit from competing for the price.

Horizontal interactions, which are conceptually seen as the organizational resources of tree grower, are the key channel for price information on eucalyptus woodlots and poles.

The group of traders is heterogeneous. The differentiation of traders is based on their function in the value chain and their geographic location which resulted in 5 types of traders. Village level traders are the most local traders. Merawi traders are the next group of traders, located at landing sites in Merawi and road No. 3 close to Merawi. They buy from village-level traders or directly from tree growers and prepare poles for further trade. Leftovers are processed to charcoal. They retail the product to Merawi consumer market and sell it to traders from Bahir Dar or other national traders and exporters. The key finding is that traders at Merawi and Bahir Dar are not further specialized for wholesaling or retailing.

Resources for traders are their trading licenses allowing them to engage in the market. Furthermore, traders at Merawi and Bahir Dar have access to landing sites. Traders appear to prefer roadside sale as it reduces their workload, but due to high competition standing sale is more common. In both ways, traders will do the transporting from the production area to Merawi town either with their truck or by hiring a transport service provider.

5.7 Governance and market knowledge

The GVC analysis concludes that the main market channel is predominantly coordinated through market governance as three out of four transactions are market-based. Munuyee (2018) concluded that the eucalyptus pole value chain in Sidama region is coordinated by market governance, as transaction complexity is low, codification of the product is high and capabilities at the supply base are high as well. Value chain studies in Uganda on eucalyptus poles (Abdul 2020) and in Southern Benin on teak poles (Aoudji et al. 2012) came to the same result.

In contrast to other studies, it was found that the standing sale transaction falls closer to relational value chains. Going back to the GVC theory, relational governance forms lead firms to rely on suppliers, which can handle complex transactions but the ability to codify the transaction is low due to the exchange of tacit information, which requires explicit coordination (Gereffi et al. 2005). In the case of standing sale, no tacit information is exchanged. The ability to codify the transactions is low due to the unprecise standards used for quantification and classification.

Gereffi et al. (2005) explain that the coordination in relational transactions is regulated by reputation, social and spatial proximity, family and ethnic ties, or through contract arrangements which penalize the party breaking the arrangement (Gereffi et al. 2005). This study found that actors use legally binding contracts with penalties for breaking the contract, which appears in line with the theory, but contracts are not limited to relational governance as simple contracts are part of market governance as well (Gereffi et al. 2005). The contracts used in the transactions of eucalyptus poles are simple, which points towards market governance.

In theory, market governance works well for standardized products as they are easily described and valued, and the transaction is coordinated by price (Gereffi et al. 2005). Woodlots are not easily described and valued as the study showed. Both tree growers and traders are aware of this inaccuracy, but tree growers accept it because the standing sale is significantly less demanding than roadside sale for them. For traders standing sale can be profitable if the woodlot value is underestimated.

The GVC governance analysis found that value at the consumer market is based on the consumer preferences for straight and high-quality eucalyptus poles independent from its diameter. This means that poles with different diameters but with the same quality are priced at the same price. In contrast in the production area, tree growers and traders base their transactions on diameter. Poles with higher

diameters have higher prices. Consequently, traders retailing in Bahir Dar benefits from the closeness to the end market and can make rent on high-quality poles due to lacking market knowledge in the supply base.

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Annex 1: List of interviews

ID	Date	Actor group	N. of interviewees	Institution	Role/Position	Location	Data		
							Notes	Audio	Transcript
1	15.03.2019	Zenbaba Union	1	Zenbaba Union	Forestry expert	Bahir Dar, Zenbaba Office	x	x	x
2	18.03.2019	Trader	1			Bahir Dar, pole landing 1	x		
3	22.03.2019	Trader	1			Bahir Dar, pole landing 2	x	x	x
4	22.03.2019	Landing group	Various		Landing group	Bahir Dar, pole landing 2	x	x	x
5	22.03.2019	Trader	1			Bahir Dar, pole landing 2	x	x	x
6	25.03.2019	Primary Cooperative	1	Tiret-Lediget PC	Marketing Expert	Bahir Dar Zuria,	x	x	x
7	25.03.2019	Trader	1			Mecha, road No.3 just outside Merawi	x	x	x
8	18.04.2019	Smallholder tree grower	2	Birhan-Alem PC	PC accountant PC member	Mecha, road No.3 just outside Merawi	x	x	x
9	18.04.2019	Smallholder tree grower	1	Birhan-Alem PC	PC nursery manger (female)	Mecha, road No.3 just outside Merawi	x	x	x
10	18.04.2019	Trader	1			Mecha, road No.3 just outside Merawi	x	x	x
11	18.04.2019	Charcoal makers	2			Mecha, road No.3 just outside Merawi	x	x	x

12	19.04.2019	Smallholder tree grower	1	Meseret-Hiot PC	PC secretary	Rim, south of Merawi	x	x	x
13	19.04.2019	Smallholder tree grower	1	Meseret-Hiot PC	PC accountant (former eucalyptus pole trader)	Rim, south of Merawi	x	x	x
14	19.04.2019	Regulator	1	Environment, Forest and Wildlife Conservation and Development Authority		Mecha, Merawi district capital	x	x	x
15	23.04.2019	Regulator	1	Environment, Forest and Wildlife Conservation and Development Authority		Mecha, Merawi district capital	x	x	x
16	23.04.2019	Transport	2		Mule cart	Mecha, Merawi district capital	x	x	x
17	23.04.2019	Trader	1			Mecha, Merawi district capital	x	x	x
18	03.05.2019	Smallholder tree grower	3	Enberta Befiker PC	Board members	Enberta Befiker, north of Merawi	x	x	x

Annex 2: Extended codebook for value chain description

Theme	Level 1	Level 2	Level 3	Definition
1 Product and markets				Information to describe the function of the eucalyptus pole value chain, such as product specification, product standards, markets, market prices, functional stages, and marketing channels. (Kaplinsky and Morris 2002; Gereffi et al. 2005)
	1.1 Product			Information on product.
		1.1.1 Quantification		How is the product quantified?
		1.1.2 Classification		How is the product classified?
	1.2 Market and product flow			Location and type of market as well as requirements and prices.
	1.3 Functional stages			Functional stages of the product.
	1.4 Marketing channels			Marketing channels of the product.
	1.5 Others			Other relevant information not fitting to the prior sub-themes.
2 Actor at the input-output structure				Information on the actor at the input-output structure regarding their activities, resources, capabilities, and further information relevant to the actor (Amit and Schoemaker 1993; Gereffi et al. 2005).
	2.1 Capabilities			Capabilities are the firm's ability to use its resources through organizational processes to perform tasks to reach a desired end (Amit and Schoemaker 1993).
		2.1.1 Activities		Activities, which actors perform to bring a product towards a market (Kaplinsky and Morris 2002).

		2.1.2 Resources		All the assets, capabilities, organizational processes, firm attributes, information, and knowledge within the firm (actor) (Daft in Barney 1991).
			2.1.2.1 Physical capital	Physical technology, plants, equipment, geographic location, and access to raw materials (Barney 1991).
			2.1.2.2 Human capital	Training, experiences, judgement, intelligence, relationships and individual insights of employees (Barney 1991).
			2.1.2.3 Organizational capital	Firm's formal reporting structure, formal and informal planning, controlling, coordinating systems and informal relations among groups within firm and between a firm and its environment (Barney 1991) as well as horizontal interaction amongst actors at similar stage in the value chain (Trienekens 2011).
	2.2. Other			Other relevant information not fitting to the prior sub-themes.
3. Transaction (vertical interaction)				Information on transactions (Gereffi et al. 2005; Trienekens 2012).

Annex 3: Extended codebook for GVC analysis

Concept	Level 1	Level 2	See Table 1	Definition
1. GVC governance	1.1 Capabilities			The capabilities of actual and potential suppliers to meet the buyers' requirements in relation to the transaction. (Gereffi et al. 2005)
		1.1.1 Capability to codify	Activities Resources	The suppliers' capability to understand and codify the transaction.
		1.2.1 Capability to produce	Activities Resources	The suppliers' capability to produce the product according to buyers' requirements.
		1.3.1 Capability to transact	Activities Resources	The suppliers' capability to do a transaction according to buyers' requirements.
	1.2 Complexity			The complexity of the information and knowledge transfer required to sustain a particular interfirm transaction, particular with respect to product and process specifications (Gereffi et al. 2005).
		1.2.1 Complexity of product	Product	Complexity of the product.
		1.2.2 Complexity of transaction	Interaction	Complexity of the transaction.
	1.3 Codifiability		Product quantification Product classification	The extent to which information and knowledge can be codified and, therefore, transmitted efficiently and without transaction-specific investment between the parties to the transaction (Gereffi et al. 2005).